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February, 1931, Vol. 118, No. 2. **Popular Science Monthly** is published monthly at 381 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Single copy, 25 cents. Nine months' subscription, $2. Yearly subscriptions to United States, its possessions, and Canada, $2.50; foreign countries, $3. A. L. Cole, President and Treasurer; R. C. Wilson, Vice-President; John Nichols, Vice-President; F. W. Briggs, Secretary.

Popular Science Monthly for February, 1931

I Have $7,000 in the Savings Bank— WHAT SHALL I DO?

By LEON MEADOW, *Financial Editor*

A LETTER received in the Financial Department the other day, seemed so well timed in the light of present market conditions that we think our readers will benefit by reading both the letter and our reply to it. In view of the personal nature of this letter's contents, we naturally refrain from revealing the writer's identity.

Mr. Leon Meadow, Financial Editor
Popular Science Monthly, New York City

Dear Mr. Meadow:

As a constant reader of Popular Science Monthly and a close follower of the financial articles, I would appreciate your advice on a situation now confronting me.

I am thirty-seven years old, married, and the father of two children—a boy of twelve and a girl of ten. While I have always looked forward to investing my hard earned savings, the first year I was married—thirteen years ago—I promised myself to resist the temptation until I could invest with absolute safety—until I had enough money left in the savings bank, after withdrawal for investments, to give me something to fall back on in case of unforeseen financial emergencies.

At the present writing I have lived up to my word and have accumulated about $7000, deposited in various savings banks in this city. What I would like to know is this: Would I be acting wisely and safely in withdrawing $5000 of this amount for investment—and, if so, into what would you suggest that I put this money?

Realizing that market and business conditions are very bad, I hesitate strongly . . . but, at the same time, I need every penny that comes my way, and could very easily use the extra income over bank interest that the right kind of investments would bring me. If I am not asking too much, I would like your sincere opinion —and your suggestions in this matter.

Here is the main content of our reply to the above letter:

The investment problem now confronting you is one which a great many men face at different times. It must be remembered that the suggestions we offer in solution are applicable principally to present day conditions. And, as you yourself put it, these conditions—both in finance and industry—are undoubtedly poor at present. That does not imply that this is a bad time for investing. On the contrary, were you a man of exceptional wealth or independence, the common stock market today offers you some of the finest buys that have been seen in years. But of course common stocks are out of the question for any man who is thinking of investing with funds drawn out of his savings account, or any money which *must* produce financial security. Fortunately, the question of investing does not end with common stocks—which can never be genuine investments for the buyer of limited means—but goes on, and points definitely to one answer: Bonds, good sound bonds. We believe that if you will bear in mind certain fundamental but important points, you will be safe in taking out of your savings bank any sum up to $5,000 and investing it in gilt-edge bond issues. This would leave you with $2,000 in the bank, and that should be an ample reserve for emergencies.

Generally speaking, good bonds are fairly high in price at the present writing, because the demand for such issues is rather large. In all periods of unsettled and unstable market conditions such as we are now witnessing, the bond market attracts the attention of a great many investors. Working on the law of supply and demand, the increased desire for bonds sends them up in price and accordingly forces down their effective interest yield. (For example: the bond that pays 5% at 100 par only pays 4.6% at 110.) Before us is a statistical chart showing that sixty of the very finest bonds available in the different industrial groups are yielding between 4½ and 5%.

We have no pessimistic desire to look at the darkest side of the situation, but nevertheless we have seen no definite and *continuous* indication of the stock market reaching a stabilized level as yet. And certainly business will not return to normal over night. The reconstruction process is more likely to be a long, steady pull up-grade. In the meantime, as the stock market feels its way to a steadier level, the demand for bonds will continue to grow larger—because *good* bonds are *always* safe in vestments—and likewise, their prices will continue to rise.

In other words, if you buy bonds now, in all probability you will realize an advance in their value: And taking the matter from the point of interest yield, bonds still seem to be an attractive buy at their current prices. A glance at the same statistical chart reveals the fact that even at the height of the 1929 stock boom, when bonds were relatively cheap because the demand was small—even then, their average interest yield did not touch 5%. Right now, with a definitely strong bond market—there are a number of secure issues that will yield 5%. So that from the standpoint of interest—this is also a good time to buy bonds.

However, to be conservative, we should place the average bond yield now at 4¾%. If you *(Continued on page 5)*

I HAVE $7,000 IN THE SAVINGS BANK— WHAT SHALL I DO?

(Continued from page 4)

withdraw $5000 from banks paying 4% or approximately $210 a year in compound interest—and use that money to buy $5000 worth of bond securities yielding 4¾%—or $237.50 a year interest you are gaining $27.50.

Now, if there were any question about the insecurity of even the finest bonds—as against the safety of bank deposits—we would naturally say that it would be unwise for you to risk any portion of your $5000 for the sake of gaining an extra $27.50.

But that is not the case. Among the industrial, rail and utility groups, you will find attractive bonds, issued by the world's leading companies. Their tremendous financial assets and structures are enough to insure the safety of your investments as firmly as any savings bank can. Because of this absolute security and because of your need for any extra income you might obtain, we believe that the right bond investments will help solve your particular problem.

In connection with the purchase of bonds, there are one or two points on which we should like to advise you. If you find yourself in a situation where you have to choose between a bond yielding 4% on a par $100 value—but now priced at 90, so that its effective rate of interest is roughly 4½%—and a bond paying 5% on a par of $100—but yielding only 4½% because it is now quoted at 110—in all cases pick the lower priced bond. That is, of course, if all other things—such as date of maturity, company earnings, etc.—are equal or offset each other. Reasons for this are as follows:

Most bonds are callable before maturity at par (100) or slightly above par. So that, in case of earlier redemption there would be a decided advantage to you in purchasing your bonds below par, whereas, in the opposite case, a loss might easily result. Perhaps this point can be made clearer to you if it is illustrated with two examples like these.

Let us consider a bond that matures in 1946 at a par value of 100—but is callable any time before then at 102½. Supposing you buy that bond today at 95. In 1933 the company decides to redeem it—at 102½. Your gain is then 7½ points in 2 years—or 3¾ points per year—as against 5 points in 15 years, or 1/3 of a point per year, should the company let the bond run until maturity and then redeem it at par (100).

Now take exactly the same bond and suppose you were to purchase it today for 105. In 1933 it is called for redemption at 102½—meaning a loss to you of 2½ points in 2 years—or, if the bond is not called until maturity, a loss of 5 points in 15 years.

Incidentally, there is another moral to be drawn from this example. That is, always investigate thoroughly all conditions, terms, and reservations with which the bond you contemplate purchasing is being offered upon the market. Take maturity dates, *(Continued on page 6)*

I HAVE $7,000 IN THE SAVINGS BANK— WHAT SHALL I DO?

(Continued from page 5)

for instance. Some bonds are non-callable—that is, the company cannot redeem them before maturity. But most bonds can be called or redeemed before maturity. In such cases, it is usual for the company to pay the holder a premium above par, although there are some few instances where bonds are callable before maturity at their par value. But, if a premium is to be paid, it may range anywhere from 1 to 10% of the bond's par value. Very often a sliding scale is assumed, in which the premium decreases as time elapses.

Concerning the maturity date itself, for a person of your means and purposes it is perhaps wise, when all other things are equal, to purchase bonds with comparatively short maturity dates. Long term securities are bought mostly by large trust funds, banks, insurance companies, and other big financial interests because they must arrive at a fixed income over a long period of years—and because expiration of short term maturity dates would involve sale and reinvestment on such a large scale that the commision and other necessary transactions would cause a decrease in the total income.

To get back to the average investor—the shorter maturity dates, the sooner you realize your profits in points, if you follow the previous suggestions when purchasing bonds. An it is also wise to remember that the shorter the term, the more profit per year for you. Time is a factor which must be considered in all investments where the profit comes from interest or rise in value or both.

Now let us briefly summarize the whole thing, and keep in mind at the same time that all this applies not only to yourself but also to every man in similar circumstances. Absolutely safe, gilt-edge bonds are now available in the industrial, rail and utility groups that will yield very close to 5% on their present market prices. In view of general, prevailing conditions as we have outlined them, and remembering always the intrinsic value of bonds themselves,—proper purchases along the lines indicated should prove not only just as safe for you as savings bank deposits, but more profitable in the long run.

To Help You Get Ahead

THE booklets listed below will help every family in laying out a financial plan. They will be sent on request.

"The Provident Provider" is a booklet describing a new savings plan which provides a regular retirement income for a man and insurance protection for his family. A copy will be mailed on request by Provident Mutual Life Insurance Company, Philadelphia, Pennsylvania.

The House Behind the Bonds reminds the investor of the importance, not only of studying the investment, but of checking up the banker who offers it. Address: Fidelity Bond & Mortgage Co., 1188 New York Life Building, Chicago, Ill.

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

Enjoy Money shows how the regular investment of comparatively small sums under the Investors Syndicate plan, with annual compounding of 5½% interest, builds a permanent income producing estate, a financial reserve for a business, or a fund for university education or foreign travel. Write for this booklet to Investors Syndicate, Investors Syndicate Building, Minneapolis, Minnesota.

How to Retire in Fifteen Years is the story of a safe, sure and definite method of establishing an estate and building an independent income which will support you the rest of your life on the basis of your present living budget. Write for the booklet to Cochran & McCluer Company, 46 North Dearborn St., Chicago, Ill.

See How Easy It Is tells how it is possible to start off with a definite plan for creating an immediate estate leading to future financial security. Get your copy of this booklet by writing to Postal Life Insurance Company, 511 Fifth Avenue, New York City.

THE FIFTH OF A SERIES OF ADVERTISEMENTS DEALING WITH ULTRA-VIOLET RADIATION IN THE HOME.

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. . They Enjoy . .

Sounder teeth, resistance to disease, straighter limbs, glowing health

THOUGH it was discovered less than a decade ago, Vitamin D might be called the mother's vitamin because of the important part it plays during the prenatal and growth years of life. Every mother is tremendously interested in the influence this vitamin has on her children.

First, in bone building. What mother does not want her youngsters to grow up strong and straight of limb? Vitamin D tends to regulate the absorption by the body of several necessary mineral elements, especially calcium. In this way it controls the growth of bone and tissue and frees children of bowlegs and other rachitic deformities.

Second, in developing sound teeth. Teeth, perfectly constructed, are much less subject to decay than defective teeth. Numerous tests which have been made, both in the United States and abroad, support the theory that poor structure is a cause of tooth decay and that the presence of Vitamin D is essential not only for the original development of the teeth but for their protection *later in life.* For example, the teeth of a mother do not suffer as they otherwise would when her supply of calcium is drawn upon by a nursing child.

Third, in building up resistance to disease. The maintenance of youthful health is the primary concern of every mother. The sunshine vitamin not only builds strong bones but helps to build strong constitutions. This is of especial concern to mothers during the winter months, when the sunlight contains only a very small amount of the normal beneficial ultra-violet found in summer sunlight.

For these three reasons every mother is vitally interested in Vitamin D. "How

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best to provide my children and myself with this sunshine vitamin?" is her first question.

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The G. E. Sunlight MAZDA Lamp is a great advance over all other methods of simulating sunshine—especially for children—because it does not frighten them. It operates without noise, fuss or mechanism. Children play, dress and read under its light just as they would under any other light in the home. To them it is just a new and wonderful "incandescent lamp."

Manufacturers, including General Electric, who make fixtures and standards utilizing this new lamp, have further developed this same idea. Fixtures and standards look like beautiful bridge or floor lamps and have no "treatment" aspect to make children apprehensive of their use. Special fixtures are necessary because the G. E. Sunlight MAZDA Lamp will not operate in the ordinary bridge lamp or fixture.

From the standpoint of mothers, another angle is of vital interest. *Safety.* To insure this, Mazda research has used in the making of the bulb of the G. E. Sunlight MAZDA Lamp a special glass which filters out practically all of the "short" or harsh ultra-violet rays not found in sunlight. In nature these are screened out by atmosphere before reaching the earth. Therefore, in using the G. E. Sunlight MAZDA Lamp it is only necessary to observe the same sensible precautions every mother would observe in bright midday midsummer sunshine—namely, prevent over-exposure and staring at the source of light.

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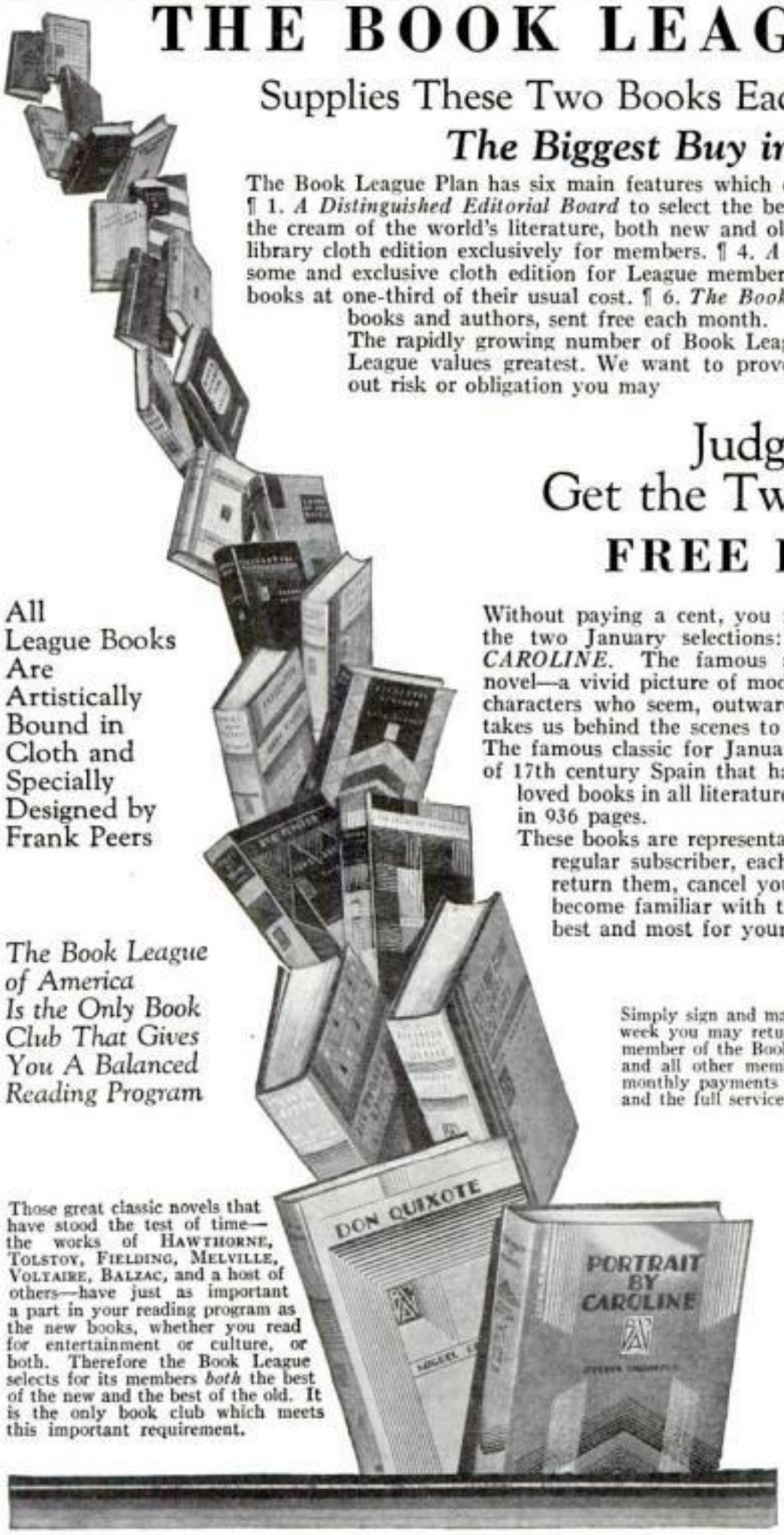

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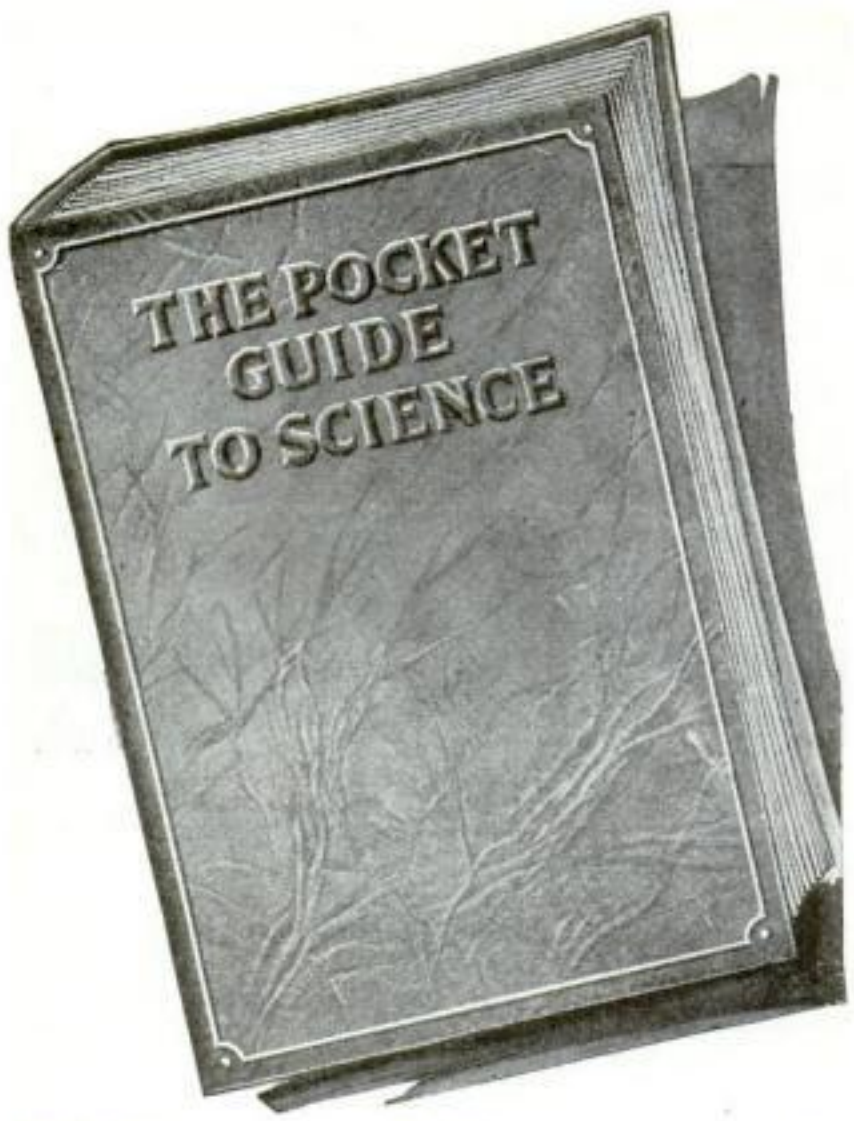

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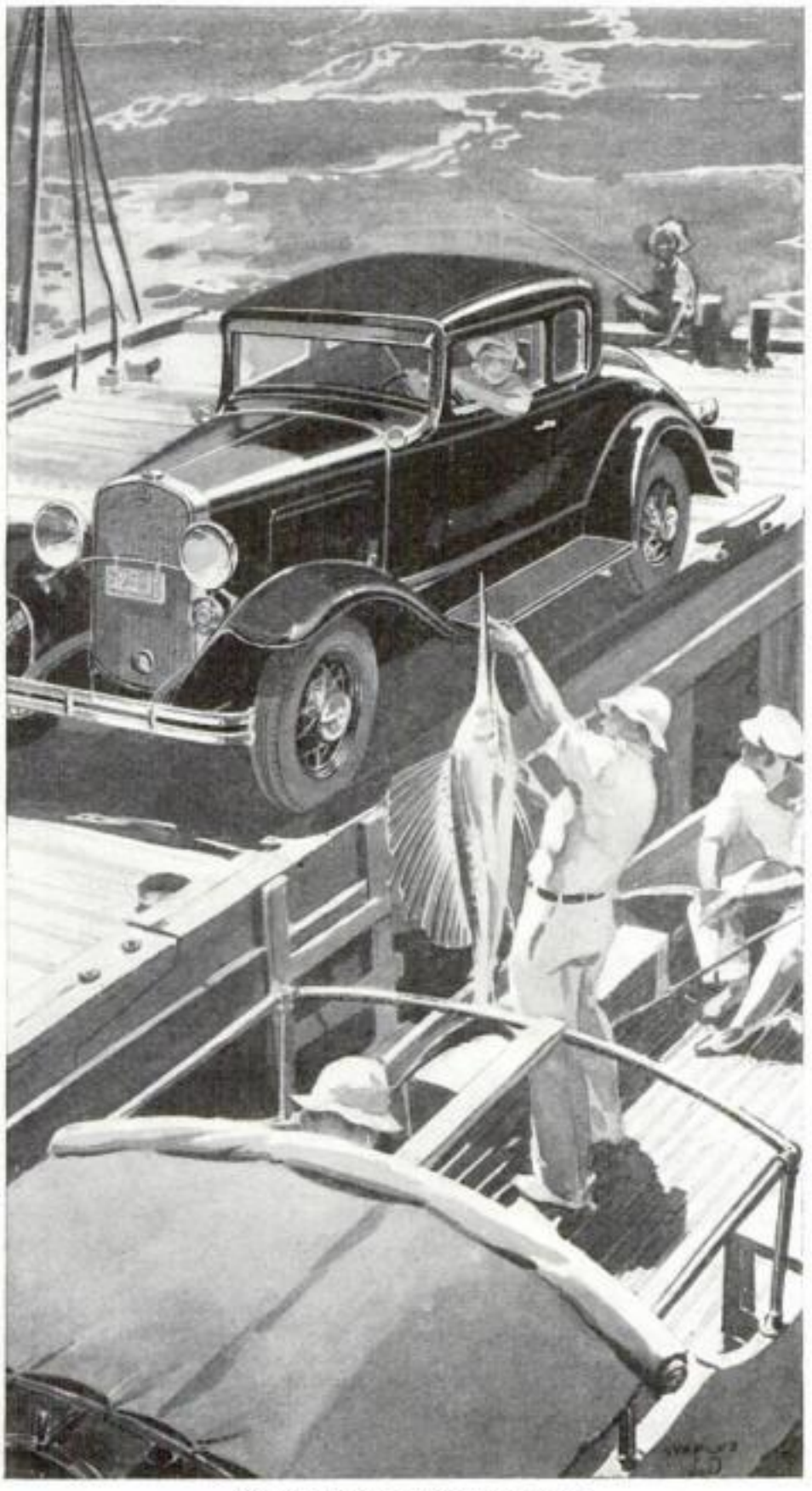

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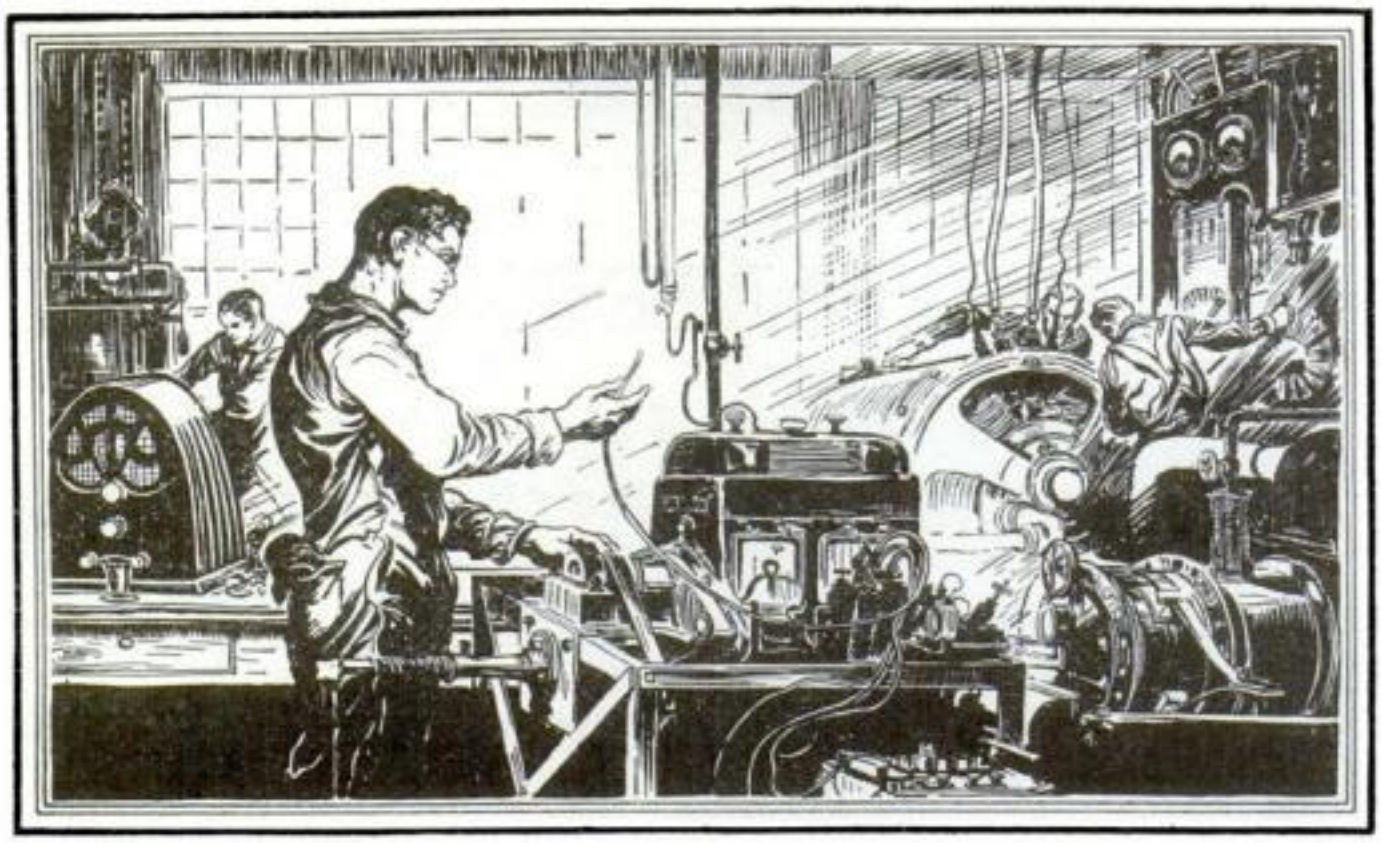
NEW CHEVROLET SIX

It's wise to choose a Six



This Research Service for You

EVERY day you can read about the millions spent for research by this concern and that; always, they are big successful firms that make a practice of watching every cent and getting full return on investments. Research must pay.

Instead of taking a chance when they buy, these great industrial organizations go to all kinds of expense to investigate equipment so that not a dollar may be wasted on anything inferior. The same applies to the various departments of the U. S. Government that likewise have found they cannot afford to gamble. So what they do is to determine, first, what they require of a product in order to get satisfaction and, second, find out what particular products meet such requirements. It is a costly procedure involving expensive tests, but they consider the information cheap at any price.

GAMBLING OR RESEARCH

The small buyer is no better fixed to gamble with his money and he is often up against the problem of buying equipment of a type with which he has had no experience, the sort of purchase that is made once or twice in a lifetime. Ordinarily, the one avenue of research open in such a case is to find out from friends what results they have had with this or that product, but the information thus gathered is too limited and partial to be of much value.

So, to help out the consumer in the field of certain semiscientific products, POPULAR SCIENCE MONTHLY inaugurated a testing service that provides the small buyer of radio equipment, tools, and oil burners with information of the sort that big business gets through expensive private research. It was back in 1924 that this service was started, and since then it apparently has been of real help to many thousands of readers, judging from the number who come back for further advice every time they buy equipment within the classification of products covered by the POPULAR SCIENCE INSTITUTE'S investigations. The INSTITUTE is glad to have so many readers taking advantage of its service, and the purpose of this article is to set forth for the benefit of new readers the exact nature of the aid at their disposal.

THE INSTITUTE'S WORK

This service consists of general information on various types of products supplied through the editorial columns of POPULAR SCIENCE MONTHLY, and specific information on particular makes of products supplied by mail to readers of the magazine on their request. It is the POPULAR SCIENCE INSTITUTE'S job to keep up with new standards and developments, to know what equipment represents good value at this particular period, and to separate generally the good from the mediocre and poor.

The products that it investigates are, as stated before, in the three classifications of radio, tool, and oil heating equipment. What the INSTITUTE does is to determine which makes are reliable and deserving of being termed the "cream" of their class, considering both price and performance. Products found to be up to requirements are put on the approved lists issued by POPULAR SCIENCE INSTITUTE, and they can be purchased with the assurance that they will satisfactorily perform the service for which they are intended.

INSTITUTE BULLETINS

Refrigeration for the Home*
Heating and Ventilating*
Insulation in Building Construction*
List of Approved Tools
List of Approved Radio Sets
List of Approved Oil Burners
Advice on Installing Oil Heat

***Starred bulletins 25 cents**

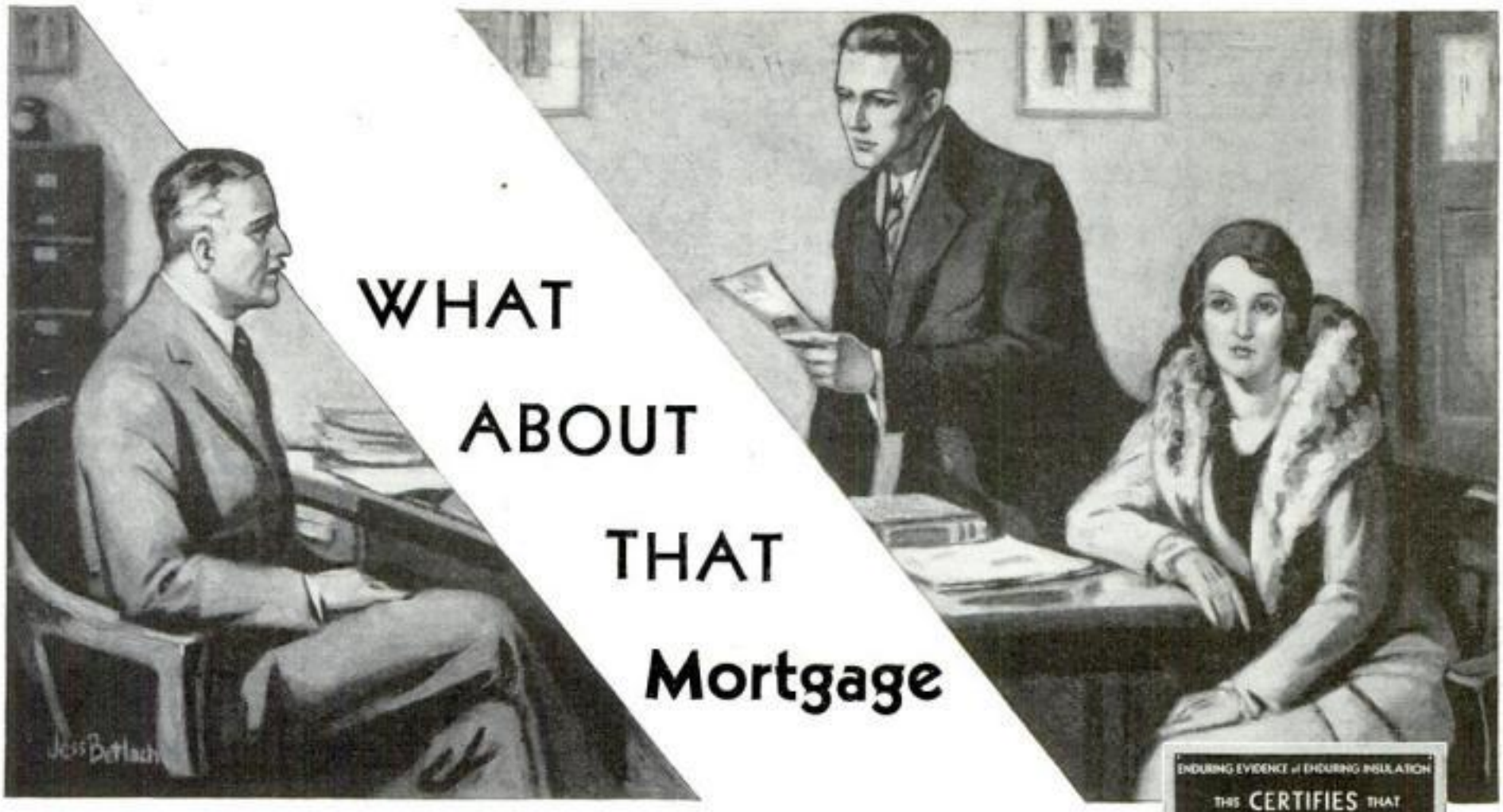
A RELIABLE AID

Of course, to make this service worth while, the investigations leading to approval must be thorough and the decisions impartial. To insure both, the INSTITUTE was put under the direction of Prof. Collins P. Bliss, Dean of the College of Engineering at New York University. As Director of the INSTITUTE, Dean Bliss' work attracted the attention of Government officials, who specially visited the laboratory and witnessed tests in progress. He was then added to the staff of the U. S. Bureau of Standards as consulting mechanical engineer.

The tests of POPULAR SCIENCE INSTITUTE are made by a staff of experts in the Sage Research Laboratory, New York University, where more than $300,000 worth of testing equipment is available. In every case, these tests are sufficiently thorough and accurate definitely to bring out the worth of a product; and it is Dean Bliss who, personally, decides whether approval is merited after he has gone over the data submitted by the engineer in charge of tests.

Equipment is approved solely on the basis of test and investigation findings and there is no relation whatever between the advertising in POPULAR SCIENCE MONTHLY and the INSTITUTE'S approvals. However, to such tools, radio products, and oil burners as lack the approval of the INSTITUTE, the advertising columns of POPULAR SCIENCE MONTHLY are closed.

The INSTITUTE will supply readers, free of charge, with lists of the products it has investigated and found to possess particular merit. The element of chance is eliminated in buying products that are mentioned on these lists, for they may be relied upon as safe guides in making a selection. To secure such lists, address POPULAR SCIENCE INSTITUTE, 381 Fourth Ave., New York, N. Y.



When it's time to renew?

MORTGAGE loan companies make more liberal loans on homes that are insulated . . . modern homes that are easy and economical to heat.

If you contemplate remodeling, or building . . . will you be able to show, after your home is completed, how thoroughly it is insulated. Remember, insulation is a concealed product, built into the walls.

This is the reason for the Insulite Metal Plaque permanently affixed in an inconspicuous place in your home. It is "enduring evidence of enduring insulation". It shows how thoroughly and efficiently your home is insulated with Insulite.

EFFICIENCY! 3,000,000 WOOD-LOCKED AIR CELLS TO THE SQUARE FOOT . . .

Thermal insulation materials achieve their efficiency to a great extent through tiny dead air cells which act as non-conductors of heat, cold, and sound. Insulite contains 3,000,000 wood-locked air cells to the square foot . . . 3,000,000 tiny barriers holding in your furnace heat, cutting your fuel bills, making your home more comfortable.

Insulite is a full half inch thick, all wood-fiber insulating board, chemically treated to resist fire, moisture, vermin and rodents—it is not subject to rot or disintegration. This means Insulite gives permanent, lasting insulation throughout the life of the building.

INSULITE INSULATION PAYS FOR ITSELF

And remember, when you use Insulite, either in building or in remodeling, it is not an expensive "extra", but takes the place of non-insulating building materials. As sheathing, Insulite has several times the bracing strength of lumber horizontally applied. As plaster base, Insulite guards against unsightly streaks and cracks, and grips plaster with more than twice the strength of wood lath.

Insulite, light cream color in appearance, can also be attractively and economically used as wall-board. Insulite is easy to handle, easy to use, and pays dividends in increased comfort and fuel savings through all the years to come.

Your architect can tell you about Insulite. He knows its strength, quality, efficiency, and economy. Your lumber dealer can supply you with Insulite.

ENDURING EVIDENCE OF ENDURING INSULATION

The Insulite Plaque pictured above is your visible proof of the efficient insulation built into your home. The Plaque is made of durable metal and is permanently affixed to the wall. Cut into the metal is the address of the house, and the amount of insulation used.

THE INSULITE CO.
(A Backus-Brooks Industry)
1200 Builders Exchange, Dept. 43B
Minneapolis, Minnesota
Offices in All Principal Cities

Send me a sample of Insulite, and a copy of your free booklet, "Increasing Home Enjoyment".

Name.....

Address.....

City..... State.....

For Efficiency and Economy be sure your Refrigerator is Insulated with INSULITE

INSULITE

the Wood-Fiber Insulating Board

For Efficiency and Economy be sure your Refrigerator is Insulated with INSULITE

Our Readers Say

Takes Rap at Our Critical Friends

HAVING missed but one number of POPULAR SCIENCE MONTHLY in five years, I believe I'm entitled to a word in "Our Readers Say" column. In the first place let me congratulate you on your success in keeping your publication interesting. Personally I am interested chiefly in the ship model and home workshop section, but I believe your policy of variety is sound and above criticism. Now for the knocks: Why do you waste valuable space on the fellows who say your magazine should be barred from the mails because of articles on the Patent Office? These "patriots" are trying to violate one of our fundamental rights, that of free speech, and, if they don't like progress, cut off their water main, electricity, papers, and radio and see how they like that! Another type of fellow I should like to see barred from your columns is the one who pooh-poohs science because his horse sense shows that science is wrong! Such people do not display horse sense but only ignorance and unjustified cockiness. Why waste space on them?—P. K., St. Louis, Mo.

But Everyone Isn't a Dr. Steinmetz

THE problem proposed by J. E. N., of Durango, Colo., is an old one. The story is told that a couple of engineers spent considerable time on it and finally put it up to the late Dr. Steinmetz, who after thinking for a few minutes, gave them the correct answer, which is 5.3333 cubic inches. The problem is really an easy one. It can be solved by calculus, but it isn't necessary to use that process. Any person capable of visualizing the solid left by the two-inch drill, and dividing it into elements of volume, can perform the operation in his head. The volume of the hole bears the same ratio to the volume of a two-inch diameter sphere as the area of a two-inch square to the inscribed circle.—J. J. R., Kearny, N. J.

There's a Catch Here If Your Bait's Right

HERE is a problem that has been worrying me for some time. A goldfish is put into a sealed glass bowl in which there is nothing but water. After the fish breathes the oxygen out of the water, there obviously will not be enough molecules of oxygen to make water. What then will be the nature of the compound in the bowl? Will it be hydrogen, oxygen, water, or what? H. G., Plaquemine, La.

Finds Lost Inch With Perfect Ease

ISN'T it odd how long pure dumb carelessness can perpetuate an obvious fake? I see the old sixty-four-inch square and sixty-five-inch rectangle wheeze has bobbed up again. It lasts only because people cut an inaccurate square from thin paper and fit the pieces together loosely in only an approximate rectangle. Absolutely accurate pieces, cut from bristol board or thin wood, will not fit together, and will reveal instantly that the rectangle has a rhomboidal hole of exactly one square inch area. The error may also be demonstrated mathematically by several methods.—J. G. H., Dunedin, Fla.

Hats Off While Grammarian Passes By

AS YOU are always ready to print anything in the way of a correction, I am sending you this about faulty diction: First, in the caption, "Try *and* Drill Your Way Through This One." Some people try and really do a thing but we generally try "to" do. Second, on editorial page in article "Who Owns the Air?" in fourth paragraph: "And there is no doubt *but what* he has committed actual trespass." "But what" should not be used for the conjunctive expression. "But that," is correct. There are cases in which "but what" can be used correctly, as "I know nothing but what you have told me." However, POPULAR SCIENCE MONTHLY is the best ever.—H. E. D., Sturgeon Bay, Wisconsin.

Readers Like You Are Our Best Advertisement

I THINK your magazine is superior in every respect. How could I live fifteen years in this country and know your magazine by name only? The only solution I can offer is that you don't advertise your magazine sufficiently. The reading matter and illustrations are so interesting that anybody who knew of your magazine's contents would buy it. —O. H., Nashville, Tenn.

Five-Year Trial Proves We're Good

I HAVE been a reader of POPULAR SCIENCE MONTHLY for the past five years and I wish to compliment you and your staff on your December, 1930, issue. I enjoyed the article on miniature trains by Frederick D. Ryder, Jr. I have a very large miniature railroad myself and I look forward to his articles with keen interest. I have nearly all my copies of your magazine on file, for they contain much valuable information. I have a workshop in my attic with a powered saw, joiner, and wood lathe. I like wood turning and I hope you will put articles of this sort in your publication.—E. T., Durham, N. C.

Lands Squarely on "Too Much Aviation"

OF COURSE we know that everyone cannot be satisfied, but we think that you are printing entirely too many articles about aviation. In your last issue there were five aviation articles to the fourteen others of general interest, including Home Workshop articles. How about other forms of transportation such as railways, buses, and boats? We, personally, are interested in railways more than the others but would like to see articles concerning all methods of transportation.—C. C. and R. G., Cincinnati, Ohio.

Couldn't Show Photo of Every Oven

IN A recent issue you show several pictures bearing the title "How the Staff of Life Is Made Here and in Foreign Countries." I should like to criticise those pictures very severely. The pictures you show of two are merely the methods used by the natives for the manufacture of bread while the bakers in those countries have some very fine bakeries. Take Canada, for instance. You have shown a small outdoor oven for family use while in the cities in Canada one may find some of the most modern bakeries in the world. In the picture representing the United States you show a large high speed dough mixer which you say shapes the loaf. This is wrong, as the mixer merely mixes the dough.—A. J. G., Billings, Mont.

L. E. R. Takes One on the Button

IN THE November issue of POPULAR SCIENCE MONTHLY L. E. R., of Louisiana, asks for more ship model construction articles and says that there are only a few people who care to build furniture. L. E. R. should inform himself better in the future. I have traveled in every state west of the Mississippi and in three Canadian provinces and everywhere have found people who not only enjoy furniture building but who are actually building it. I have seen hundreds of pieces of furniture patterned after the plans given in POPULAR SCIENCE MONTHLY, and I have heard many of them say that they

Wet feet breed SORE THROAT

gargle with Listerine— reduces mouth germs 98%

WET feet, sudden changes of temperature, over exposure, fatigue, all are predisposing causes of colds, grippe, sore throat and kindred infections.

They weaken body resistance so that germs in the mouth get the upper hand.

Reduces mouth germs 98%

As an aid in guarding against these troubles, medical authorities recommend the morning and night gargle with full strength Listerine, the safe, healing antiseptic and germicide.*

Listerine actually reduces germs in the mouth 98%. Kills them by millions, outright! Repeated tests following the methods used at famous universities and laboratories of international repute prove its amazing germicidal power.

Gargle every 2 hours

Under ordinary conditions of health, the night and morning gargle is sufficient. But when you feel a cold or sore throat coming, or are already in the grip of either, increase the frequency of the gargle. Every two hours, authorities urge. Hold the liquid in the mouth as long as possible so that it reaches germ-ridden surfaces.

Such frequent gargling aids your body, weakened by the cold or sore throat, to overcome millions of disease-producing organisms in the oral cavity.

Intelligent men and women everywhere use Listerine as both a precaution against and a treatment for colds, sore throat and allied infections. Keep a bottle handy in home and office and use it at the first symptom of trouble. Lambert Pharmacal Co., St. Louis, Mo., U. S. A.

Gargle every 2 hours

***Listerine though safe and healing in action is one of the most active germicides known. It kills even Staphylococcus Aureus (pus) and Bacillus Typhosus (typhoid) in counts ranging to 200,000,000 in 15 seconds (fastest killing time accurately recorded).**

THE SAFE ANTISEPTIC LISTERINE

KILLS 200,000,000 GERMS IN 15 SECONDS

wished your magazine would publish more articles on furniture building. Please give us more on this line for there are literally thousands of us who are not like L. E. R.—H. A. E., Lone Tree, N. D.

Success of Others Perks Him Up

JUST a line to show my appreciation of our POPULAR SCIENCE MONTHLY. I say "our" because it has become as vital to me as to its editor and publisher.

I keep four or five copies handy at all times, which I read and reread several times between editions. I read everything between its covers and find nothing that I would be content to leave out. When tired and discouraged I pick up POPULAR SCIENCE MONTHLY and read of other people's achievements, then think of the numerous failures and disappointments surmounted before each new creation. I forget my own troubles and glory in their spunk and success. I find things directly applicable to my own business (as all mechanics can in a book like this), which makes lighter and speedier work and stimulates the making of quick and correct decisions. All I say is, give us more of what we have, and anything else that is good.—O. B. H., San Luis Obispo, Calif.

Yazoo Delta Pleads for Fuse Plug Levee

IN A recent issue of POPULAR SCIENCE MONTHLY, I note an article on Mississippi flood control by General Jackson. Naturally this article caught my attention because I am an active sufferer from the periodic floods in the Yazoo Delta. After a careful reading of General Jackson's words, I can find nothing that holds out hope for the people of this region. To build our levees higher is suicidal, as we have not the foundation upon which to rest them. The 1928 act of Congress promised us Fuse Plug Levee at Cypress Creek on the Arkansas River. This Fuse Plug Levee is about to be denied us in favor of reservoirs. These are untried defenses and will not give us any relief for a generation or more. Something must be done to lower the water line in the main river and so take the pressure off the levees. Our safety and future depend on the immediate opening of the Cypress Creek spillway and the widening of the river at Natchez and Vicksburg.—D. H., Fallula, Miss.

Sharpens Her Knife to Defend Lindbergh

IN SPITE of your article, "Air Progress from Lindbergh to Coste," I still think that Lindbergh's flight is the greatest in all the history of aviation. Lindbergh flew alone. His flight fired the imagination of the world, while Coste's flight did nothing of the sort. I insist that personalities win for aviation and Lindbergh has the personality. Most people do not know or care about the danger of flying the ocean. It was the twenty-five-year-old boy, with the kid attitude, who referred to himself and plane as "we," who is responsible for our air-mindedness. Let's have more of Lindy in your magazine.—Mrs. M. B., Rochester, N. Y.

Has Flexible Stone from North Carolina

IN AN article in the December number of your magazine is the description of a piece of flexible stone. The article also states that "it is believed that a similar stone may be found in North Carolina." I have a piece of that flexible stone on the desk beside me. It was given to me by a jeweler about two years ago. He said it came from North Carolina. For three years I have had a subscription to the POPULAR SCIENCE MONTHLY and I surely was glad when you made two pages of "Our Readers Say." Can't you make it three just to please your fans? —J. M. W., Braddock, Pa.

Where We Would Be Without Railroads

I READ in your "Our Readers Say" a letter signed W. J. M., of Macon, Ga. He states that when you say that railroads operate at sixty miles an hour you seem to overlook the fact that it takes a lot of force to hold a 500-ton train on the rails at that speed, around curves. You say that railroads operate at this speed and over only because they have skilled operators and safety devices. You are perfectly right. If he does not agree I will let him know that the Union Pacific Railway has large, powerful, mountain type locomotives that can do one hundred miles an hour if necessary, with a train of from ten to twelve heavy steel cars, and I have never known one of these engines to meet with an accident caused by excessive speed. I also see many others knocking the railroads, and giving aviation the highest praise. The railroads have for a century given the country invaluable service, and if they should stop operating, even the most earnest aviation enthusiast will have to admit that the country would be thrown into a state of chaos. Food would soon give out; automobiles and airplanes could not get gasoline; little or no freight could be transported, and business in the cities would be paralyzed. —S. P. B., Brooklyn, N. Y.

Gets Money's Worth Just As It Is

I HAVE noticed considerable criticism of POPULAR SCIENCE MONTHLY on "Our Readers Say" page. In general these critics tell you what you should cut out and what you should add to the magazine. Now in my opinion if you dealt only with one or two subjects you would not have a POPULAR SCIENCE MONTHLY but you would have more of a trade paper, and then what would your circulation be? There are several parts that I do not read as I am not interested in the subjects treated and there are other parts that I would like to see more of but I would not ask for them unless I were in a position to pay extra for them. My hobby is models and small cabinetwork including fretwork and I can honestly say that I get good value from the magazine as it is.—P. M. D., Luseland, Canada.

Your Nut Problem Has Many Answers

YOUR correspondent, C. W., in POPULAR SCIENCE MONTHLY for December, 1930, is mistaken in thinking his African nut problem has only one solution. It has an infinite number of solutions of the form N=3125 n-4 where N is the original number of nuts and n is any positive integer. The smallest value is of course given by n=1, N=3121.—L. B. T., Washington, D. C.

Untrue and Ridiculous—Anything Else Wrong?

I FIND the article "America to Save King of Horses" in your November issue absurd and untrue. The subtitle, "Few Survivors of Fleet Arab Steed Left—Plans are Laid to Rescue Breed from Extinction," is ridiculous in the extreme. Do you know that here at Blida, Algeria, the French government has a remount station of over one hundred pure-blooded Arab stallions and that every spring these horses are placed all over northern Africa for the service of the Bedouin tribes and Europeans who care to use them? The French government also has several hundred pure-blooded mares loaned out to those who promise to raise a colt each year. The one thing in the article mentioned that stirred me up more than anything else was the statement that France is a financially hard-pressed country. All I wish is that we Americans were as well organized as the French.—R. I. McC., Souma, Algeria.

No Horse Sense but Answer Is Right

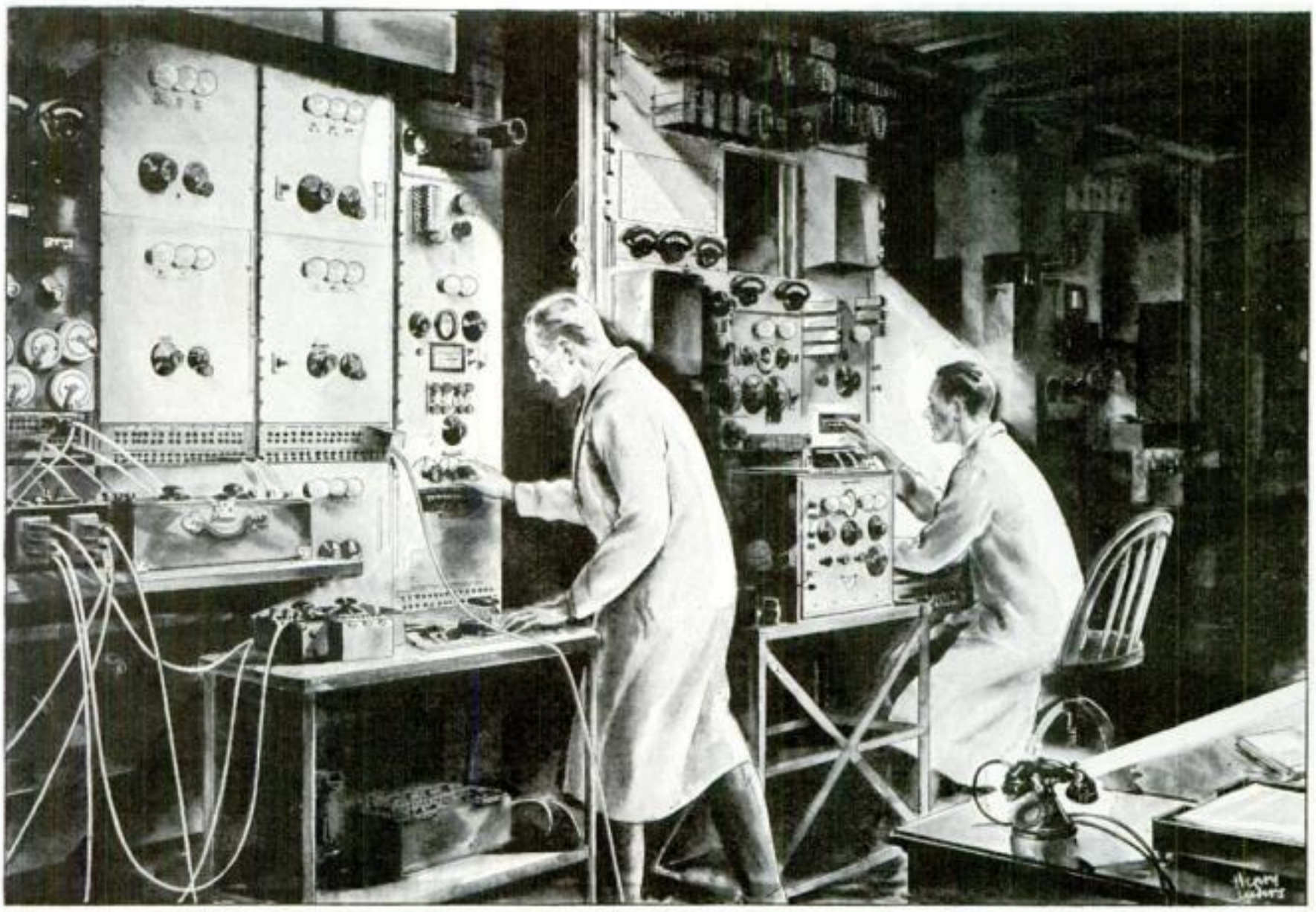
IN THE November issue of POPULAR SCIENCE MONTHLY T. R. W., Pittsburgh, Pa., said that horse sense, not algebra, was needed to solve the problem about how fast a stream flowed. By means of elementary algebra I proved that the stream flowed three miles an hour. No other method of solving would work and I should like to know how it is done by "horse sense." Probably I am dumb but I cannot see how horse sense would help in this case. Please publish some more problems.—R. D., Barrytown, N. Y.

Wants to Build Model of the Bremen

I HAVE made quite a few models from your plans, particularly airplane models. Looking over some old copies of POPULAR SCIENCE MONTHLY I ran across a drawing of the German steamship *Bremen* made especially for your magazine by B. G. Seielstad, in your October issue of 1929, page twenty-two. I thought it would be an ideal model to build, if you could publish plans I think it would be a great piece of art work.—J. A. G., Ottawa, Can.

Why Does Rock Lose Weight in Water?

HERE is a question I should like to ask M. J. K., of Chicago, Ill.: Is it the upward pressure of water that causes a rock to lose weight when it is submerged? My professor in physics said yes, but I always disagreed with him and he was never able to show where I was wrong, though he had all the books on physics to back him up. If I am wrong I should like to be shown where I have made a mistake.—E. A. D., Gorham, N. H.



THE STEADY SCIENTIFIC PROGRESS OF THE BELL LABORATORIES SHOWS IN THE EVER-INCREASING QUALITY AND SCOPE OF YOUR TELEPHONE SERVICE

To clear all barriers for the human voice

An Advertisement of the American Telephone and Telegraph Company

BELL TELEPHONE LABORATORIES, Incorporated, is the scene of a progressive conquest of natural forces that aims to let you speak clearly, quickly and cheaply to any one, anywhere in the land and even to distant countries. More than 5000 scientists and assistants are busy there and elsewhere in the Bell System studying the problems of sound transmission. Its work is the growing foundation of the telephone art; and it has, besides, helped to make possible the radio, sound pictures and special apparatus for the medical profession.

Among its achievements are the underground cables which make city telephone service possible, better and faster long distance service, service to ships at sea, and to millions of telephones beyond the seas. The steady scientific progress of the Bell Laboratories shows in the ever-increasing quality and scope of your telephone service. Its new developments in every type of equipment clarify and speed up your telephone talks and give you more and better service at low rates. Every advance it makes is available throughout the Bell System.

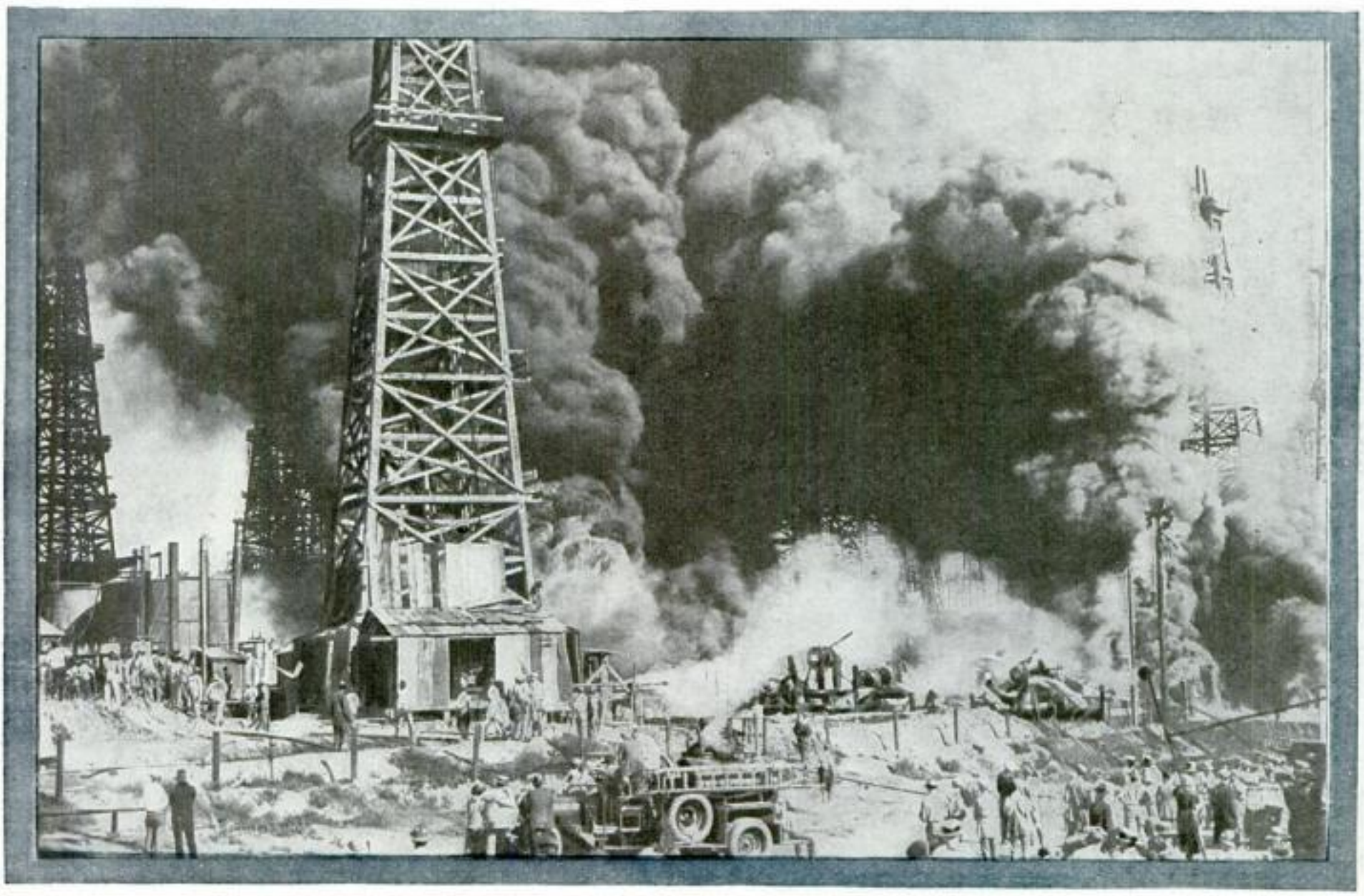
The Bell System is an American institution owned by more than 500,000 stockholders. It places before you the benefits of its technical achievements and the co-ordinated efforts of more than 400,000 trained workers. It accepts its responsibility to further the development and welfare of the nation by furnishing the public the best of telephone service at the least cost consistent with financial safety.

POPULAR SCIENCE MONTHLY

· FOUNDED 1872 ·

FIFTY-NINTH YEAR

February, 1931 · RAYMOND J. BROWN — *Editor* · Vol. 118 No. 2



Great oil well fire at Signal Hill, Long Beach, Calif. In the oil fields of this same state one of the record disasters of the industry occurred when firemen fought a burning well for 26 days before capping it.

How Wild Oil Wells Are Tamed

MILLIONS of dollars may be lost when a gusher throws its oil and gas into the air, and efforts to choke it may take their toll of human life. To prevent these disasters now is the aim of all engineers connected with the hazardous work of oil drilling. This remarkable article tells why wells go on a rampage, what damage they then do, and the means employed to subdue these mad underground giants.

By JESSE F. GELDERS

A NATIONAL Guardsman runs up to the door of a bungalow and raps imperiously.

"No fires here!"

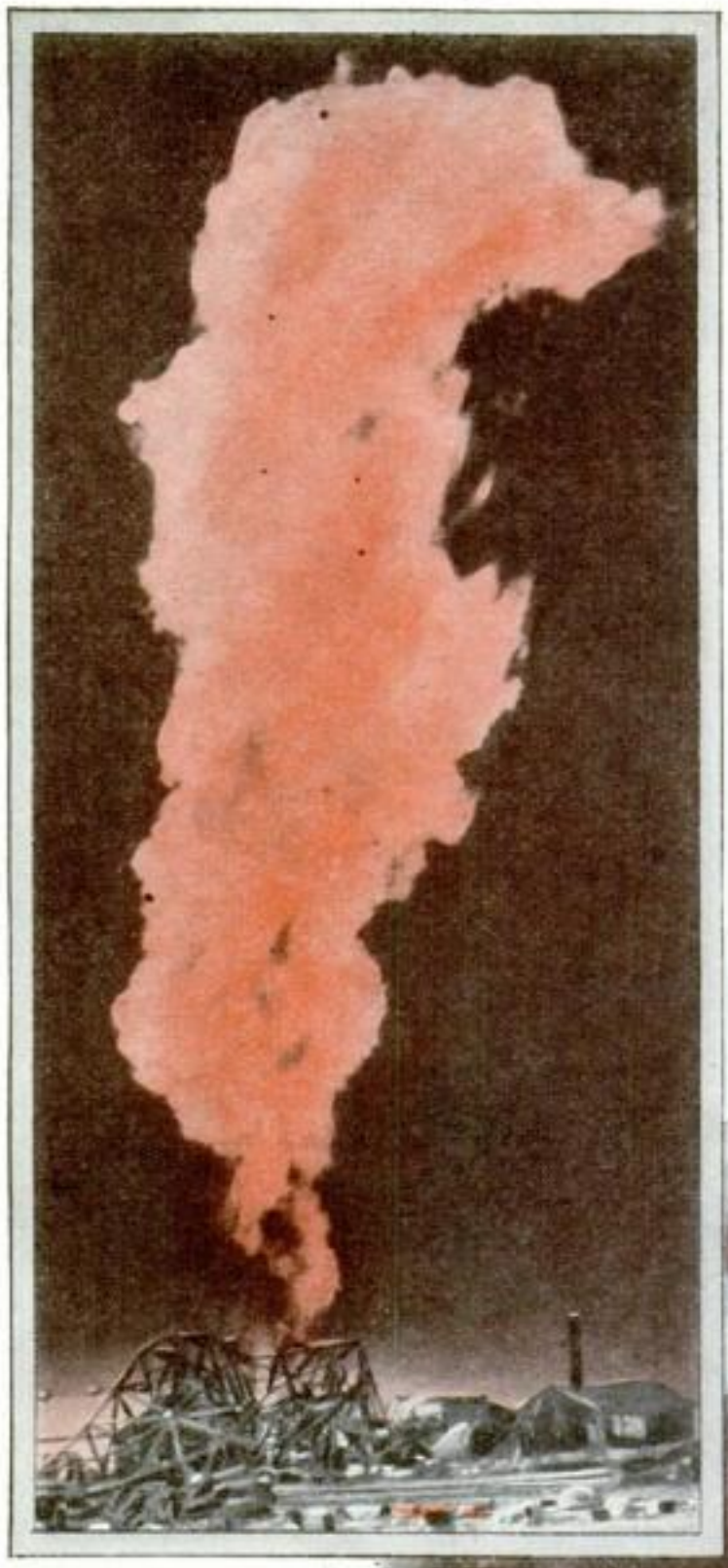
Inside a man faces him, protesting. "But my wife is just cooking supper. It'll spoil. We've got to cook it."

"Sorry. No fire," the Guardsman repeats firmly. "Do you want to blow yourself up? And everybody else in this end of town? Put it out. Quick!"

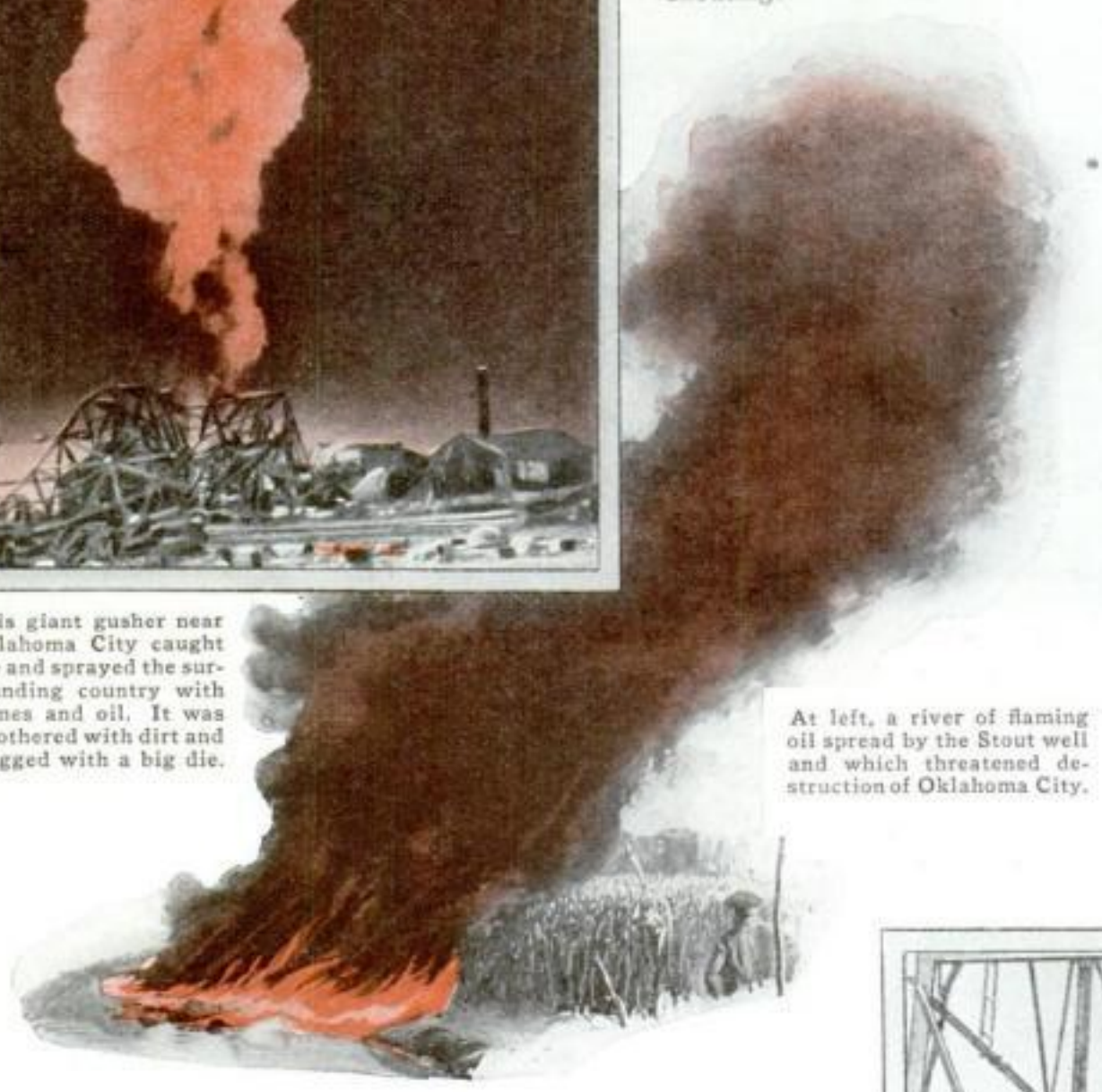
The fire is extinguished. The Guardsman hurries down the street. Five hundred other Guardsmen, firemen, police, and deputy sheriffs are busy in the threatened district, laboring without rest in a determined effort to save lives.

It is the southeastern sector of Oklahoma City late last fall. A little over a mile away, an oil well has gone wild. It is bombarding the sky with 60,000 barrels of oil and 100,000,000 cubic feet of gas a day.

The rusty black torrent shoots upward



This giant gusher near Oklahoma City caught fire and sprayed the surrounding country with flames and oil. It was smothered with dirt and plugged with a big die.



At left, a river of flaming oil spread by the Stout well and which threatened destruction of Oklahoma City.

as if from a cannon, it roars through the top of the 120-foot derrick, drenches the surrounding land, sends a golden slimy mist on the wind to the city. Invisible clouds of gas drift close to earth, hanging in the lowlands since the wind is too mild to carry them away.

Around the well, men in steel helmets and dripping slickers are making ready for an attempt to staunch the flow. In a machine shop in another part of town, out of range of the oil and gas, men, working with all possible speed, are building a "Christmas tree"—a heavy, forty-five-foot pipe device that will be used in the effort to cap the well and hold back that roaring geyser of oil and gas.

Mail and passenger planes bound for Oklahoma City airport have been warned. They swing around far to the north to avoid the gas-laden air.

M. K. & T. trains stop beyond the city limits, and passengers are relayed to town by bus. Other railroads send their engines into the restricted zone with the fires doused and boilers full of reserve steam.

At one danger point firemen are stringing 2,000 feet of hose. Chemical wagons and foam tanks are in readiness. At Red Cross headquarters, 100 experienced men and women are being organized into a first aid unit. Autos are turned back from the restricted zone. Only essential traffic is permitted. There must be no unnecessary risk of igniting a stray gas pocket.

Suddenly there is a commotion. Whistles blow. Guardsmen run through the streets shouting:

"Get out! Go north of Fourth Street! Everybody out! Get away at once!"

There is a fire! Black smoke rises like storm clouds on the horizon to the south. The blaze is in oil-soaked, vacant land between the well and the city. The wind whips it over a hundred acres. If it spreads north it will catch oil drenched houses. If it goes south and leaps across the narrow river, it will fire the gushing well.

Firemen, Guardsmen, and oil field workers rush to the blaze. Two hundred of them beat it out, spade up the soil, turn under the flaming grass.

THE "Christmas tree" is finished, with a massive die nipple to fit over the mouth of the well. It is hauled to the scene. Men work in shifts, in the rain of oil and the sickening clouds of gas. Their ears are stopped with cotton, to prevent deafness from the roar.

The Christmas tree, with the giant die nipple attached, is dragged into the derrick, hoisted high above the floor, moved into the torrent of oil. At the base of the pipe, huge fan blades in a funnel-like arrangement guide the device to the center of the flow. It descends inch by inch. The oil is shooting up through the pipe and spouting above the derrick.

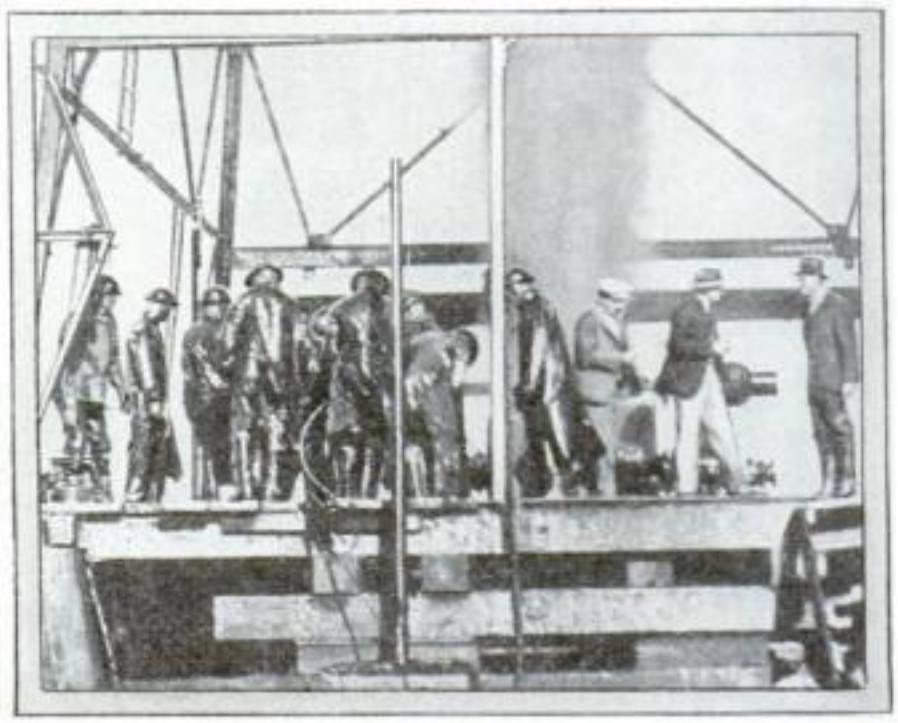
The connection comes down over the casing of the well, where the original master gates have been torn away. Men seize long levers, throw their weight against them, turn the die. Its teeth bite new threads into the casing. It fits tight. It is anchored down with chains.

The Christmas tree has a series of valves. One at a time, they are closed. Little by little the mad gusher is choked. The last stream dies. The struggle is won!

During the three days the well was wild, thousands of barrels of oil flowed into the North Canadian River. A great part of this escaped the skimming plant installed to reclaim it, and floated on downstream. Then, somehow, this oil caught fire, and quickly the whole river was ablaze! The flames destroyed two bridges, one of them a steel span structure, some thirty miles from the well.

WHAT happened at Oklahoma City was not only thrilling; it was *important*, because it showed what *might* have happened.

Oil wells flow chiefly because of the pressure of gas contained in the porous rock or sand from which they are producing. Water pressure is another factor. Many wells with insufficient gas, or none, fail to flow and have to be pumped. In the end, when the power is spent, this is the fate of them all.



At left, the apparatus to be used in an effort to choke the Stout gusher is being assembled; at right engineers plan final work.

Car Dial Warns of Deadly Gas

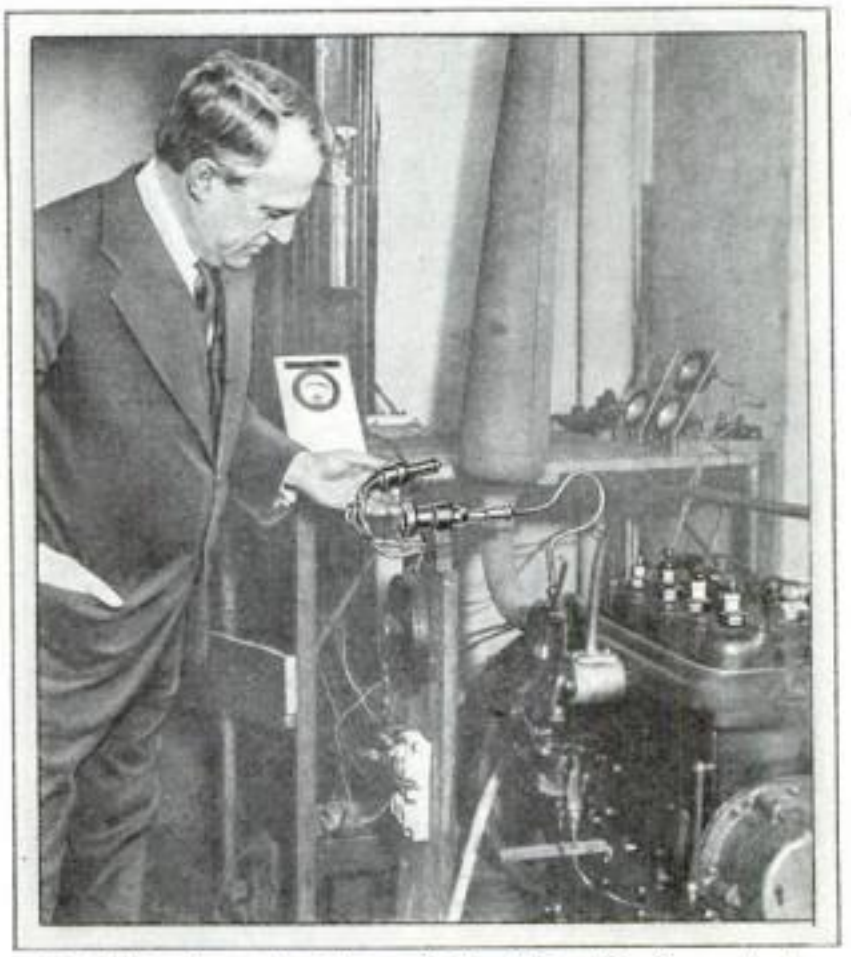
Attachment for auto shows presence of poisonous carbon monoxide which can be eliminated by adjusting carburetor—Use of device, inventor says, would stop waste of billion dollars a year for gas that, unburned, goes out into the air with exhaust.

By ALDEN P. ARMAGNAC

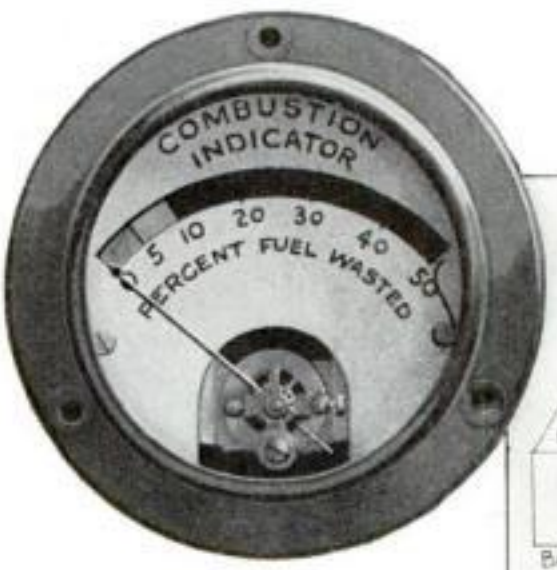
A SIMPLE device that can be attached to any automobile in a few minutes may rid city streets of the peril of poison gas. Dr. Miller Reese Hutchison, New York inventor and former chief engineer for Thomas A. Edison, announces that after two years' work he has perfected a "monoxide meter" for cars. It will warn a driver when his car's exhaust is belching fumes of the deadly carbon monoxide gas. Also, it will help him to get more miles to the gallon of gasoline.

The device is hailed as one of the most important contributions to automotive engineering in recent years. It comes from an engineer already noted for his inventions. If a motor horn halts you as you cross a street, the chances are good that it is one of a type that Hutchison patented. Business men owe him a debt for the invention of a dictating machine. He has aided the deaf with more than one device to improve their hearing. Now this energetic, gray-haired man, at fifty-four, gives a new proof of his versatility.

Carbon monoxide, the evil fought by the new invention, is the gas that kills motorists who run their cars' engines in closed garages. A pall of it, diluted by air, hangs near the surface of city streets. Though the passer-by might not notice it, the gas is thick enough to imperil the health of traffic officers and others who must stand in the street for hours at a time. It comes from the exhausts of motor cars with improperly-adjusted carburetors, which supply an engine with too "rich" a mixture of gasoline and air. A perfectly-tuned car will not produce carbon monoxide. It is always a sign of imperfect combustion in the car's motor.



Dr. Miller Reese Hutchison, of New York City, demonstrating a model that tested the value of his monoxide meter.



The dial on your dashboard to warn of deadly gas.

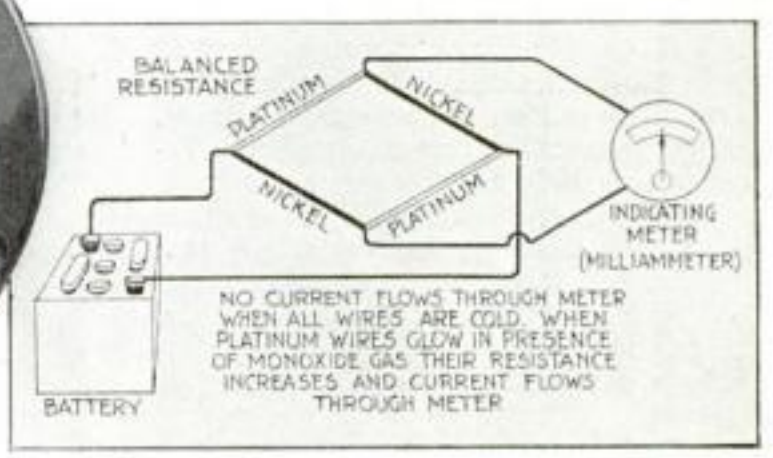
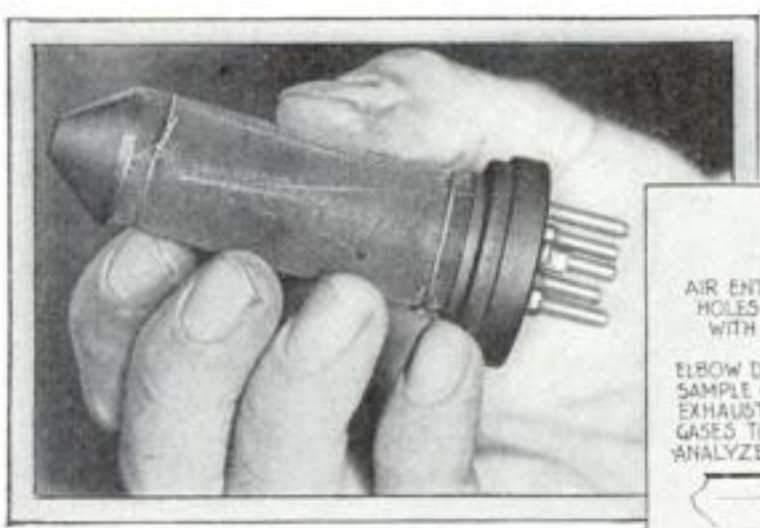


Diagram makes clear how dial pointer is actuated.

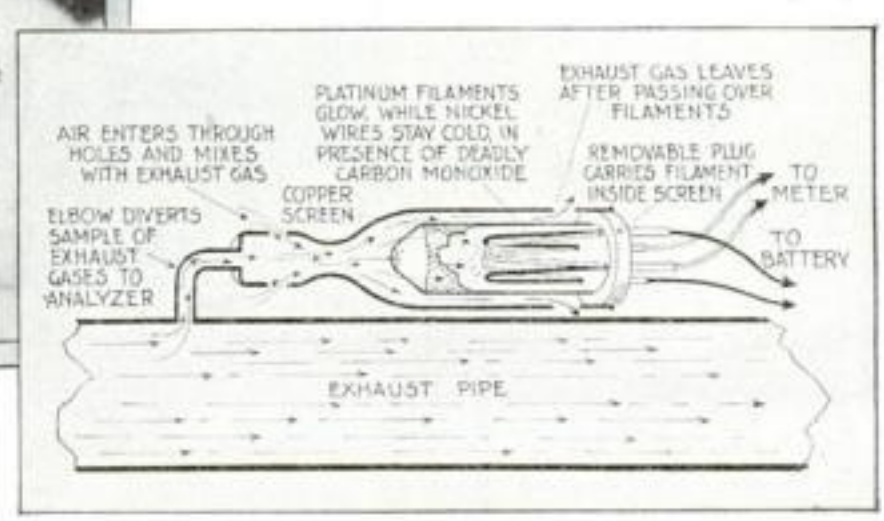
Unseen by the motorist, but really the brains of the device, is a little brass tube a few inches long clamped upon the exhaust pipe. It might be called a mechanical chemist. Constantly it samples and analyzes the gas rushing out through the exhaust. At the first sign of the deadly monoxide, it flashes a warning to the meter on the instrument board through electric wires.

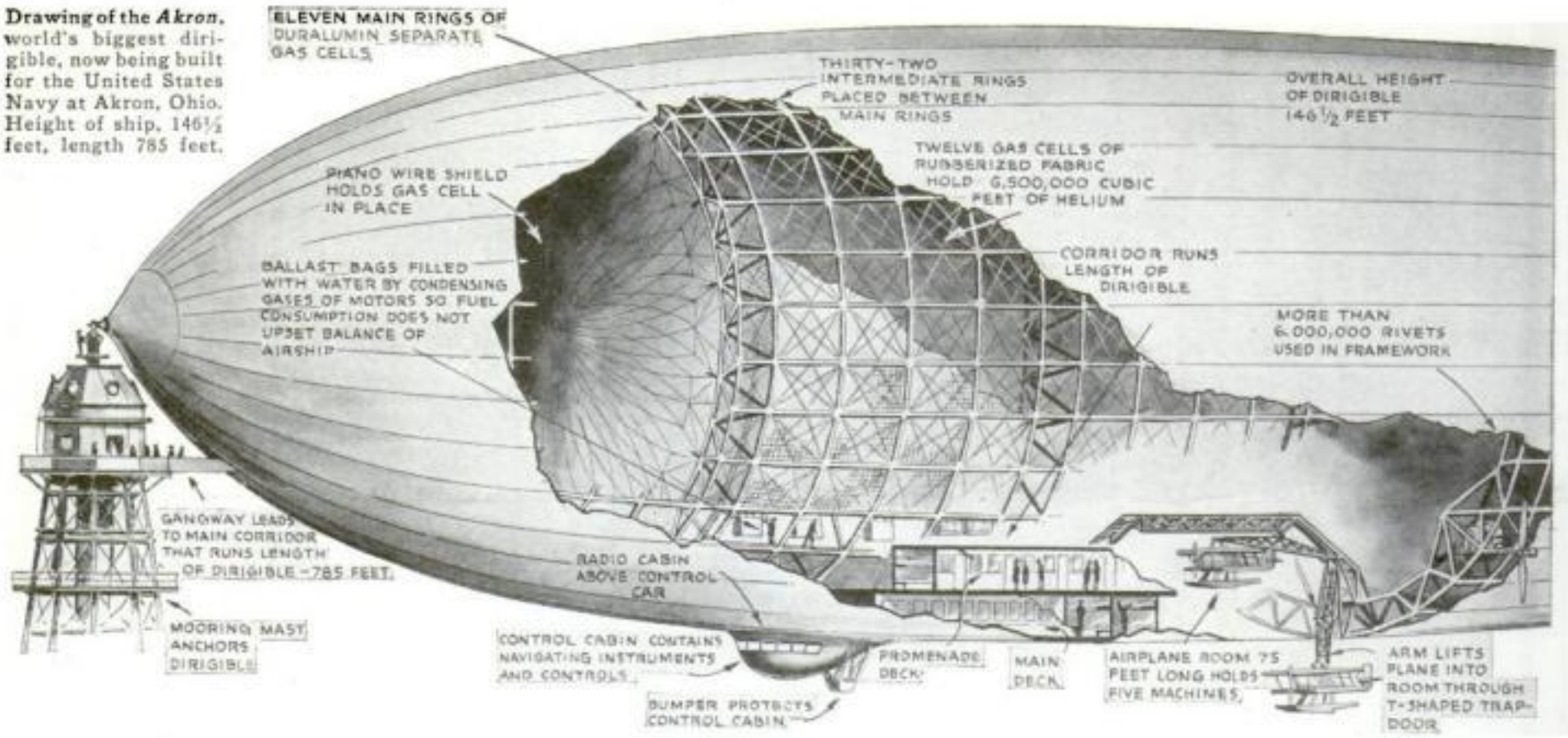
Its working parts are simple. Anyone who has seen a certain style of lighter for gas ranges, in which a coil of "sponge" platinum thread, a porous form of the metal, glows when held over flowing gas, will understand at once how it works. Thin ribbons of platinum, specially-treated in the tube attached to the exhaust pipe, glow as does "sponge" platinum when an inflammable gas, such as carbon monoxide, mixed with a little air, passes over them. The "catalytic" or uniting action of the platinum in both cases promotes a chemical process resembling combustion between the gas and air, and the platinum glows with the heat resulting.

In the gas-analyzing tube, the platinum strips are connected in an electrical circuit with *(Continued on page 151)*



This plug, which slips into the gas-analyzing tube, contains the telltale platinum filaments that reveal the presence of monoxide. At right, drawing shows how this plug works.





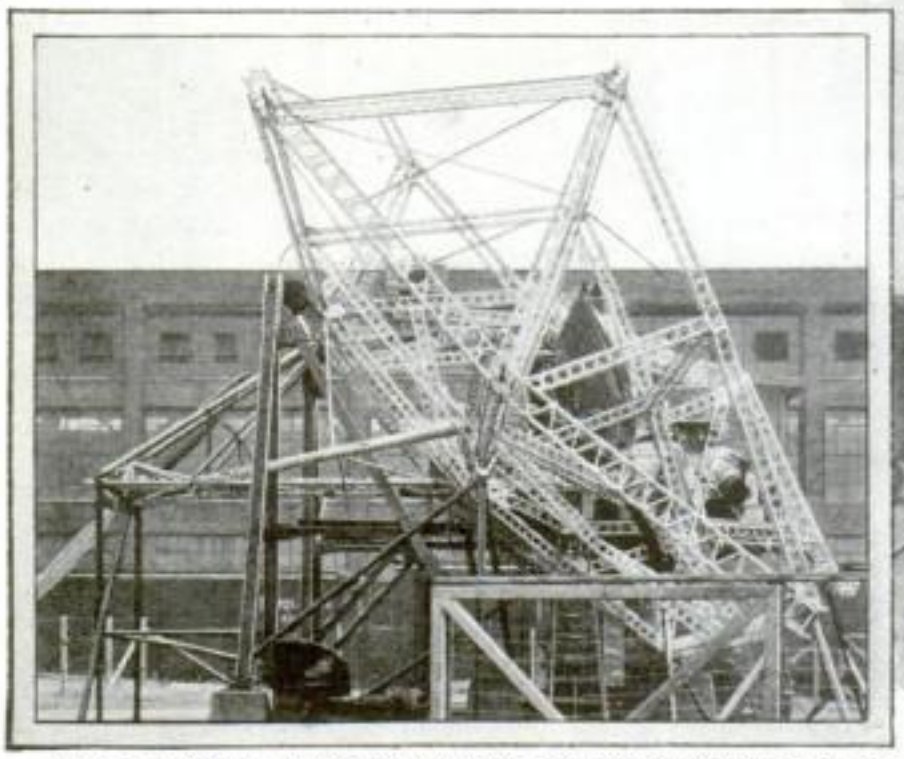
Drawing of the *Akron*, world's biggest dirigible, now being built for the United States Navy at Akron, Ohio. Height of ship, 146½ feet, length 785 feet.

World's *Biggest* Airship to Fly in May

By WALTER E. BURTON

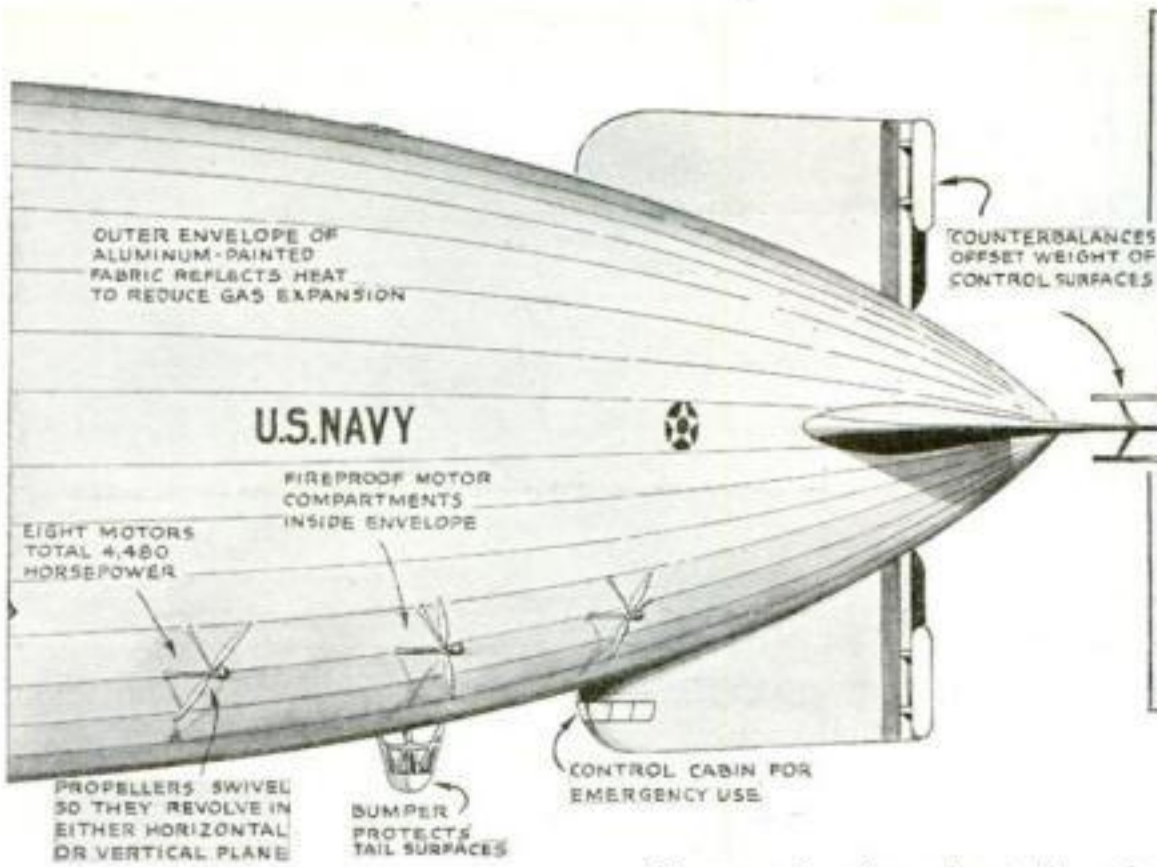
ONE of the most successful shows in the world from the standpoint of attendance is now playing at Akron, Ohio. The stage is a nine-acre steel shell on the municipal airport, and the players are scores of expert workmen who climb, like so many monkeys, about the aluminum alloy framework that soon will be the Navy's new airship *Akron*.

Ever since it was decided to throw the Goodyear-Zeppelin airship dock open to the public, there has been a steady pilgrimage of the curious to this center of America's airship industry. Every day they come, regardless of weather. The doorman at the dock checked 30,000 of them on a single warm Sunday late last fall. The following Sunday, with the temperature hovering about the freezing point, 12,000 were counted. Every day, from nine in the morning to five in the afternoon, anyone may enter a fenced-off section of the airship dock and watch the giant Zeppelin almost silently taking form. But what is there about the spectacle that attracts such huge crowds?



Above, a full size model of an engine room of the *Akron*, built for motor testing. At right, Dr. Wolfgang Klemperer, famous glider pilot, demonstrates to Dr. Karl Arnstein, designer, and Lieut. Settle, left, Navy inspector, one of ship's propellers.

For one thing, the American public only once before has had the opportunity of witnessing actual construction of a rigid airship—that is, the *Shenandoah*, in 1921-23. Air-mindedness, coupled with curiosity, probably accounts for many of the visitors. But whatever the primary attraction, every spectator is impressed by the bigness of the dock — large



Putting the girders in place and riveting them solid. The rivets are not hammered home but are forced tight with squeezers exerting 6,500-pound pressure.

enough to hold the National Capitol with room for a White House or two in addition—and of the airship, which will hold 6,500,000 cubic feet of helium.

Probably few of those who are not privileged to walk from one end of the dock to the other and inspect the vessel at close range obtain a truly accurate impression of size. For instance, from the floor the airship looks as if it were almost scraping the roof girders of the dock. But, if you were to ride up the crablike elevator that goes sidewise as well as up and down, you would find, upon viewing the busy scene from the catwalk 200 feet above the floor, that the top of the hull is actually several stories below your feet.

AT FREQUENT intervals on the busiest visiting days, a police officer turned orator tells the spectators about some of the features of the dock and the airship. Someone inquires about the wires that look like the web of a giant spider. These wires are everywhere—lacing together the framework of duralumin girders that looks like a lacework of larger threads.

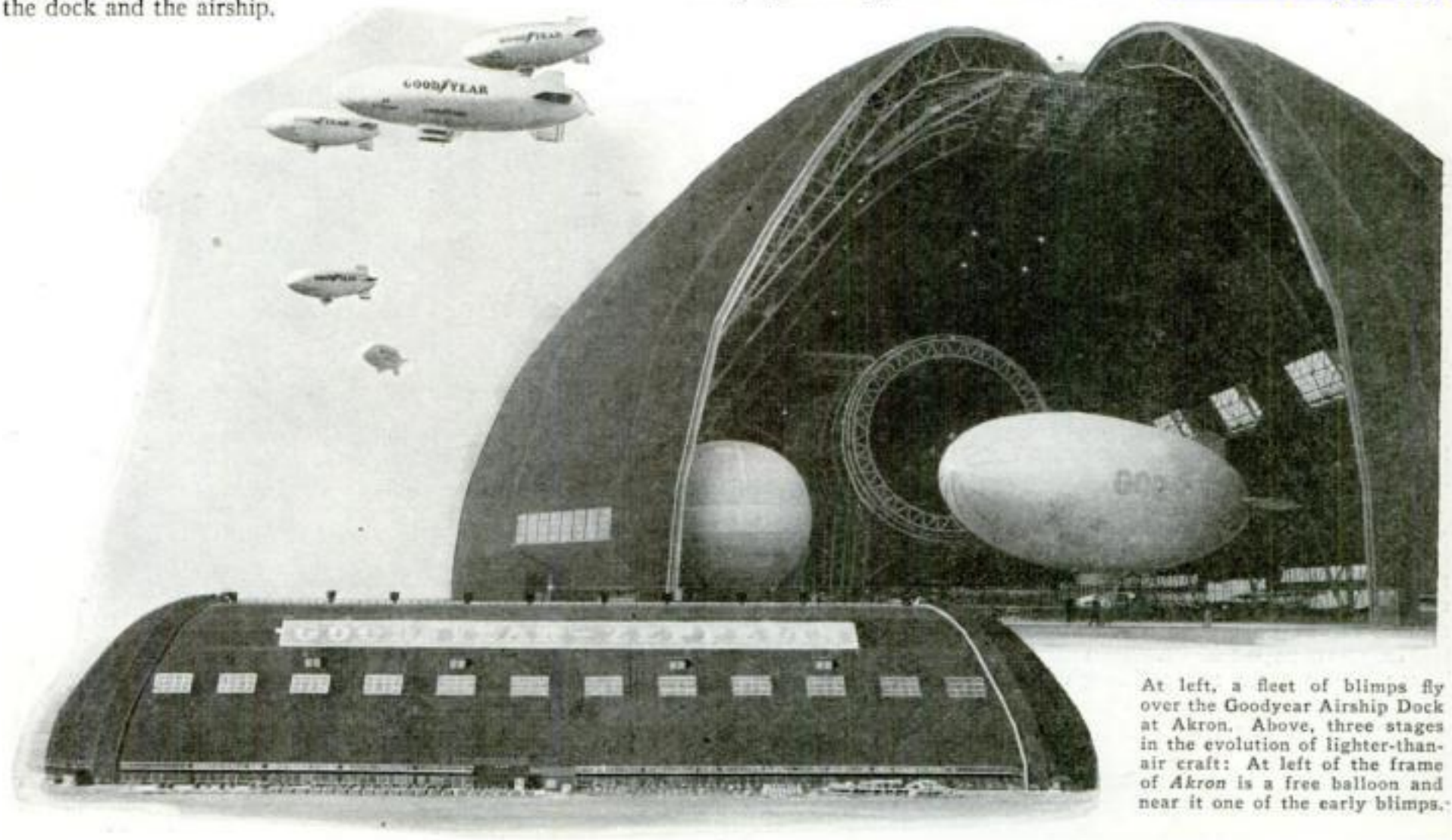
YOU could play a symphony on the bracing wires of the ship. The various lengths, diameters, and tensions employed cover a considerable portion of the musical scale. Steel piano wire, treated to make it corrosion-proof, is used throughout because it provides the greatest strength for a given weight. There will be between 1,250 and 1,500 miles of this wire in the completed ship!

Nine different diameters, ranging from .047 to .135 inch, can be counted. The wire is all put under a tension that varies from fifty to two hundred pounds. As a result, the framework of the Zeppelin will have a rigidity and strength for all practical purposes as great as if it were made in a single solid piece.

The largest wires are employed in the making of bulkheads—the network that separates adjacent gas cells. At the circumference of the huge, almost circular frames inclosing these cells, the bulkheads are attached to resiliency devices. These correspond to shock absorbers on an automobile. If a gas cell loses some of its helium, the adjacent cells will have a tendency to expand and fill up some of the space. The resiliency devices will serve to keep such expansion under control, yet permit an equalization of pressure.

Perhaps you would ask, if you were visiting the dock, how the girders are fastened together. The answer is rivets—6,500,000 of them. It is a coincidence that there is almost exactly one rivet for every cubic foot of helium lifting gas the *Akron* will carry.

There is a little story behind those rivets. For one *(Continued on page 138)*



At left, a fleet of blimps fly over the Goodyear Airship Dock at Akron. Above, three stages in the evolution of lighter-than-air craft: At left of the frame of *Akron* is a free balloon and near it one of the early blimps.

Uncle Sam *Exposes* Fake Cures

Swindle Remedies, Tried in Government's Laboratory, Prove Worthless—Invalids, Seeking Health, Bunked Out of Millions

By EDWIN W. TEALE

Hanging yourself up by this phony device was guaranteed to increase your stature.

LESS than a dozen blocks from the White House, in Washington, D. C., a small group of men working in a laboratory saved American citizens $20,000,000 in the last two years by exposing medical and mechanical frauds through scientific tests.

Known as "Collaborative Investigations," the laboratory is operated jointly by the United States Department of Agriculture and the Post Office Department to examine devices and concoctions which are sold through the mail on claims that are believed to be fraudulent.

More than 400 such frauds, calculated to extract money from the pockets of the gullible, were tested last year. They ranged from "Radium Glasses," promised to make the stone blind see, to "Infra-Red Ray Skullcaps," guaranteed to grow hair on a head as bald as an egg!

One of the weirdest of these fake devices was a "Height Halter," the use of which, it was promised, would add from two to six inches to the height of the buyer. It consisted of a collar arrangement, fitting around the neck, to which was attached two lengths of rope cable ending in handles. These cables were slung through loops from a bar or beam and the user pulled down on the handles, thus lifting himself up by the neck.

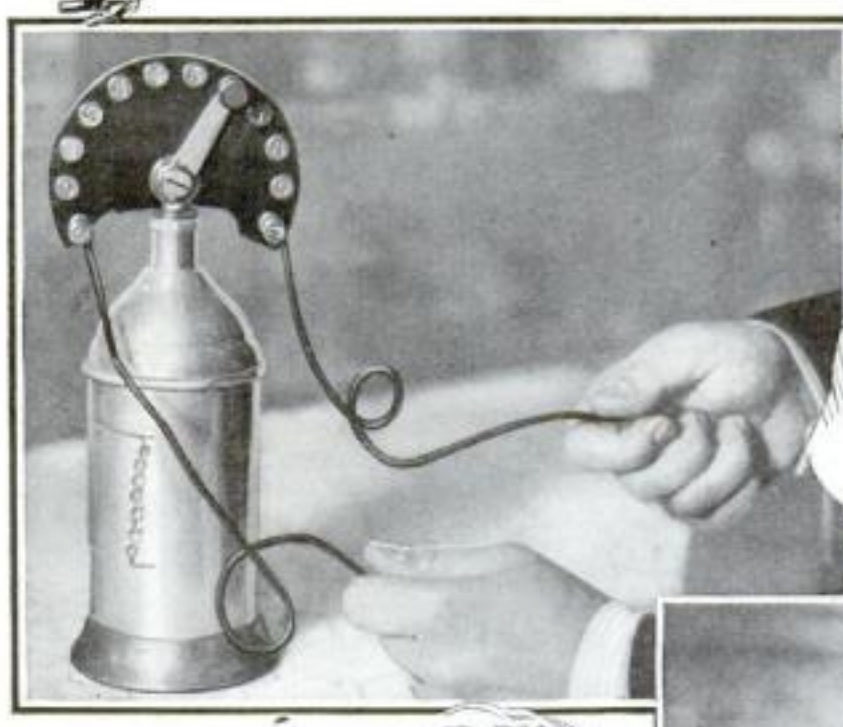
This was supposed to lengthen the spine and make giants out of pygmies. The funny part of it was that when the promoter of the fraud was arrested, he proved to be only five feet four inches tall. His explanation was that he had been so busy selling his device to other people that he had never had time to use it himself!

As each new discovery of science is announced, the crooked quack proclaims it a cure-all and reaps a harvest from the sick and the gullible, unless he is stopped by the investigations in the Washington laboratory. At the present time, the catchwords most frequently used by the quacks are "electricity," "radium," and "infra-red rays." To the ignorant person, these are vague, miracle-working terms from the world of science which suggest infinite possibilities.

Electricity is the "come-on" word most frequently employed. Not long ago, the laboratory examined a device selling for $35. It was a small section of polished gas pipe with wires coming out of welded-in plugs at each end. All the user had to do was to throw the pipe in a fish bowl, attach one of the wires to his wrist and the other to his ankle, and sit and rock in a rocking-chair.

THE beneficial electric current which was supposed to be generated inside the pipe would flow through his system with its wonderful healing and curative powers and rid him of everything from chilblains to cross-eyes. When the laboratory scientists examined the glorified gas pipe, it was found that the only way to see what was inside was to saw the pipe in two. When they did this, they found it was filled with gravel and sand.

Another device was more elaborate. It



Current from this handy little electrical device is controlled by the lever, only there's no current to control. The bottle was found to contain sulphur and graphite.

Here is the infra-red cap, advertised to cure baldness and incidentally stop all toothache.

was a bottlelike metal cylinder with a lever at the top that could be moved over a series of metal disks numbered from one to nine. Two wires coming from the apparatus were held in either hand.

The amount of the healing current that entered the system depended upon which of the disks the lever touched, the directions stated. When the lever touched nine, the maximum amount of electricity entered the body—which was exactly none. For, when laboratory workers broke into the cylinder by boring a row of holes up the side and sawing across it, they found that the main element in the mixture inside the device was dirt.

THE fact that alternating copper and zinc plates are used in batteries to produce electricity is frequently employed by quacks as a selling point for worthless devices "guaranteed" to work wonders.

The simplest of these frauds, which sold like hot cakes, was uncovered not long ago by the laboratory. It consisted of a copper plate, to be worn in the right shoe, and a zinc plate, to be worn in the left. The result, the promoter promised, would be a constant electric current running through the body "invigorating the nerves, toning up the system, and absolutely eradicating rheumatism."

Goiter, another crooked advertiser promised, could be cured quickly by wearing a string of "electric beads." Between each of some two dozen amber beads was a tiny zinc plate, and the whole was strung on a copper wire. The electricity, which was supposed to be generated by the copper and zinc coming in contact, was expected to stimulate mysterious glands in the neck and cause the goiter to disappear.

The most elaborate of the devices based upon this form of deception was an outfit known as "Heart Batteries." Strapped to the front of the body, just over the heart, was a large copper plate. On the left side of the back, a zinc plate was held in place by similar straps. The electric current was said to pass through the body from one plate to the other, purifying the blood as it entered the heart and preventing hardening of the arteries.

Even in examining such self-evident frauds as "Electro-Chemical Rings, guaranteed to extract acid from the blood," the laboratory must make searching tests. Often, one of the workers will follow the directions for the use of the fake electric device while a sensitive galvanometer shows if any current is passing through his body—which, of course, there isn't.

At top, the magic churn that was sold to turn one pound of butter into two. All it did was spoil a pound of good butter. Immediately above, the "cure" for tuberculosis. It held nothing but charcoal, sulphur, and oil.

No matter how wild the claims, the laboratory, to obtain a conviction, must have absolute proof that they are fraudulent. The promoter is considered innocent until he is proved guilty. So there must be no loophole left for the wily crook to slip through.

WHEN a complaint reaches the Chief Post Office Inspector from someone who has been duped by a curative fraud, he sets into motion the wheels of an official investigation. Evidence is first obtained that the mails were used in selling the worthless device or compound.

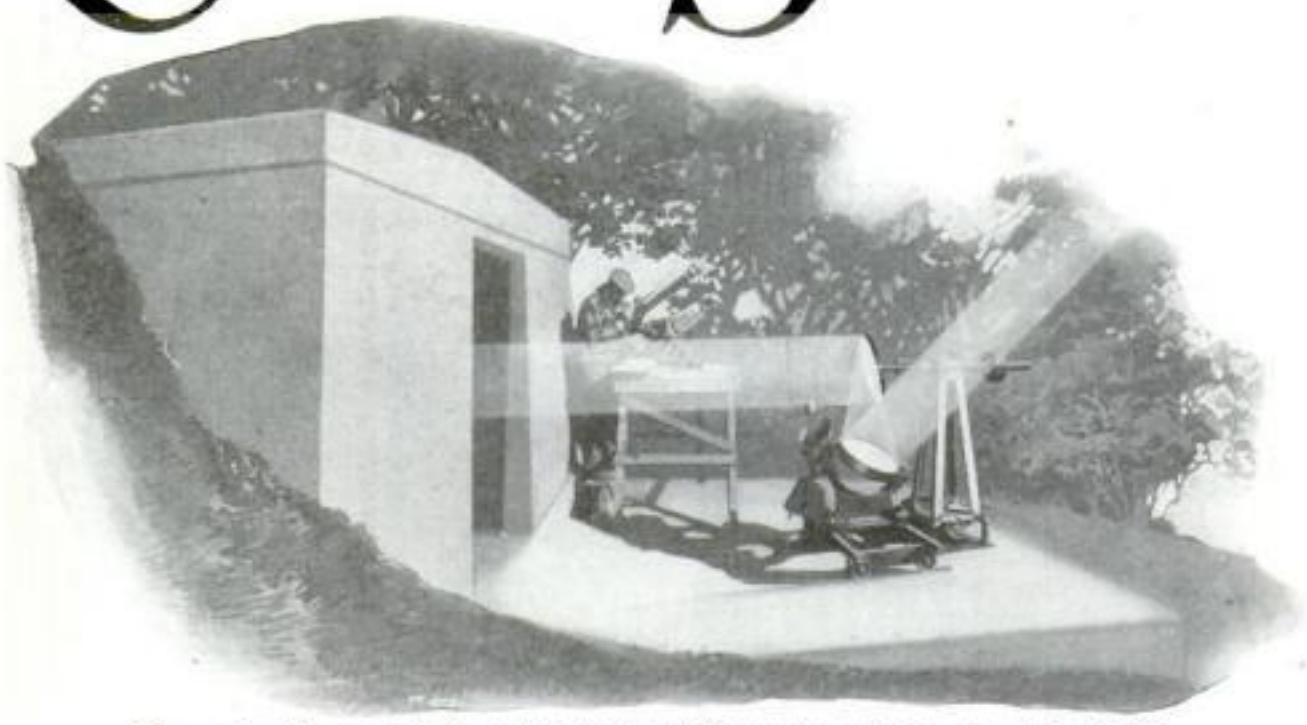
After that, the Collaborative Investigations laboratory begins its examination and makes its report. Then the Solicitor for the Post Office Department hands down a decision as to whether the law has been violated and the defendant is given a hearing.

If he is convicted, the Postmaster General issues a "Fraud Order." This bars the promoter's advertising from the mail and returns all letters addressed to him to the senders stamped "Fraudulent." Those who are cheated by such frauds can best help in catching the crooks by

(Continued on page 146)

In center, the sex tester, a little red peg that was supposed to tell the sex of the unhatched chick. In circle, the fat reducer, a vacuum cup to draw off surplus flesh.

Calls Our *Sun* Huge Electric *Light*



Measuring the sun's heat at Smithsonian Observatory, Table Mountain, Calif. Coelostat, at right, reflects rays to bolometer, which records millionth of degree.

Government astronomer advances amazing new theory as to cause of solar activity—Power generated there so vast human mind cannot imagine it—What observers learned from eclipse

By ROBERT E. MARTIN

OUR sun is a huge electric light. All the stars, suns more or less like ours, are twinkling electric lights each with a filament a hundred thousand miles in length.

This is the startling new theory of the nature of the sun and of the universe advanced recently by Dr. Ross Gunn, of the United States Naval Research Laboratory, Washington, D. C. Dr. Gunn says that electricity runs the sun and that it glows exactly as a man-made incandescent electric lamp glows.

Millions of volts of electricity, he told me, turn the solar atmosphere into a vast incandescent filament that furnishes our light and heat. So great is this flow of power that he estimates, if it were paid for at present rates, the entire wealth of the United States would be required to keep this celestial lamp shining for one millionth of a second!

For more than four years, Dr. Gunn has been working upon the intricate mathematical calculations which have led him to his revolutionary conclusion. Astronomers at Mount Wilson Observatory, California, have made careful measurements of the strength of the magnetism around the sun.

These studies showed that the sun has a magnetic field similar to that of the earth. Starting with these observed facts, Dr. Gunn began his calculations and built up his theory that explains several of the hitherto baffling puzzles about the hub of our universe.

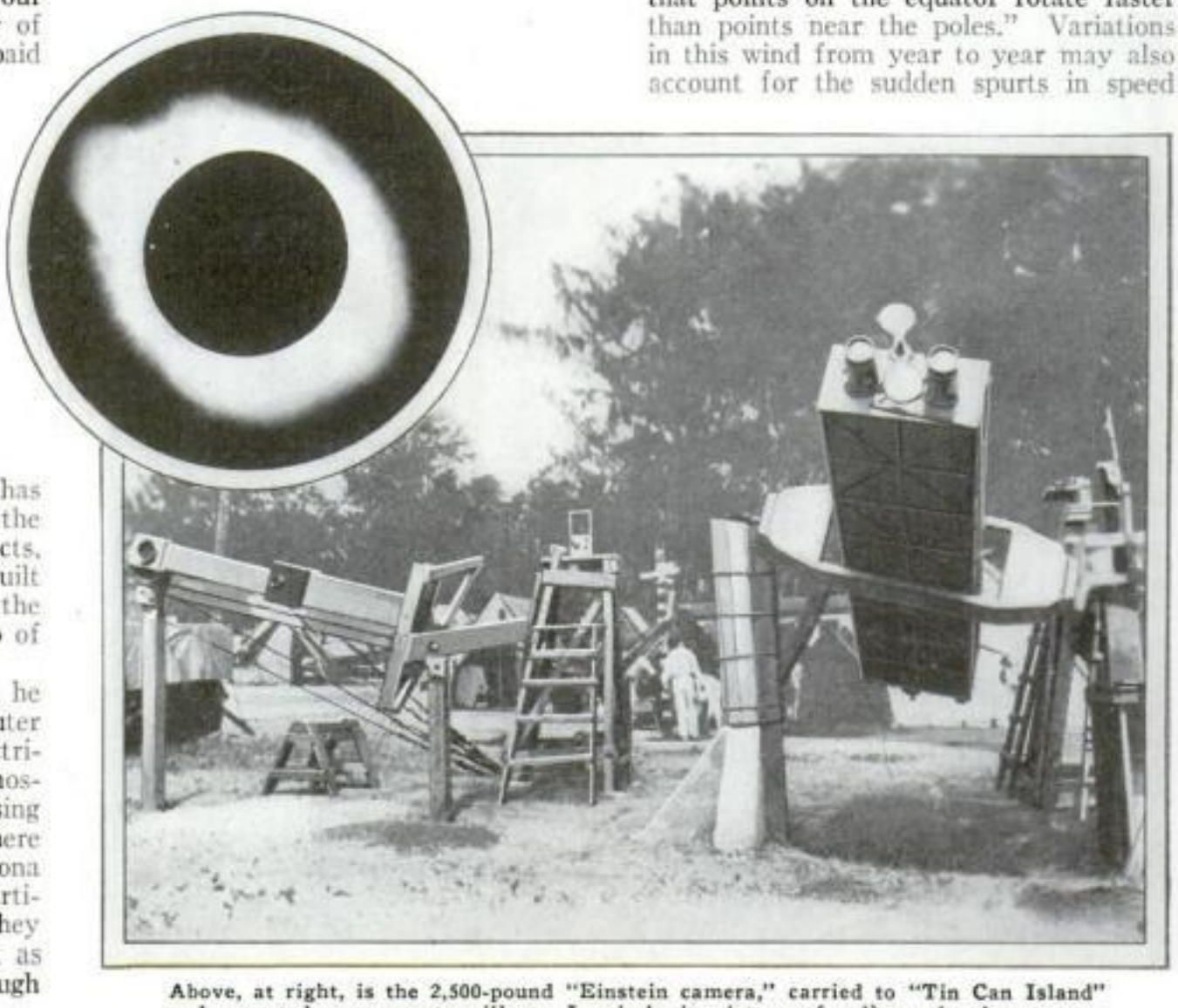
From the surface of this giant star, he assumes, there are streaming into outer space ions charged with negative electricity. In passing through the solar atmosphere, which consists of the reversing layer nearest the sun, the chromosphere above it, and the shooting, flaring corona at the outer limits, the electrified particles meet resistance. As a result they heat the gases to incandescence, just as does the electric current passing through the filament of an ordinary bulb.

For nearly a century, astronomers have noted a perplexing fact about the rotation of the sun. Instead of spinning like an ordinary sphere, different parts rotate at different speeds. By timing the reappearance of sun spots, watchers found that at the sun's equator a revolution took twenty-five days. Halfway to the poles there was a lag of two days, while at the poles a complete turn requires six days longer than at the equator.

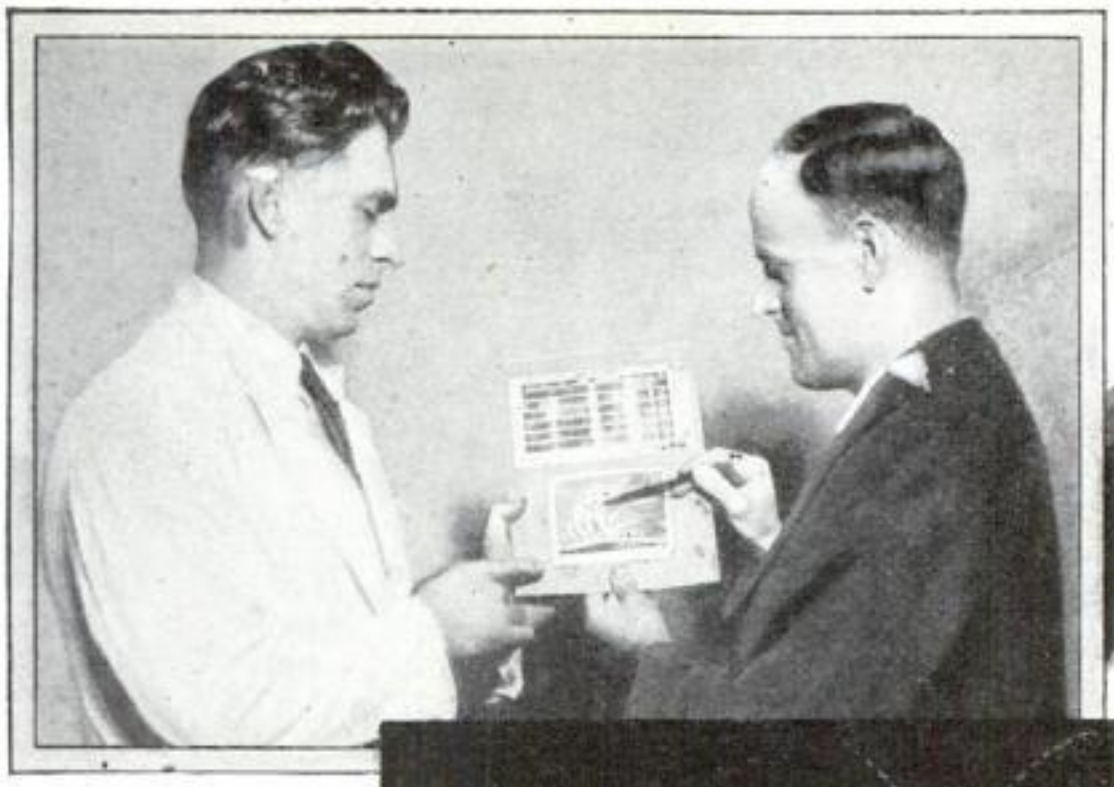
More than this, the speed with which the sun revolves is not constant. The flaming ball speeds up and slows down. Over a period of five or six years, the pace at which it rotates may alter as much as seven percent.

Dr. Gunn's theory suggests a solution for these mysteries. The action of the electricity in the upper reaches of the reversing layer and the chromosphere, he says, produces a wind in the solar atmosphere. This "electrical wind" reaches a speed of about 1,200 miles an hour at the equator, but blows slowly at the poles.

"Since an astronomer on earth can see only the atmosphere of the sun," Dr. Gunn points out, "he sees this high wind superimposed upon the ordinary rotation of the sun proper and he naturally reports that points on the equator rotate faster than points near the poles." Variations in this wind from year to year may also account for the sudden spurts in speed

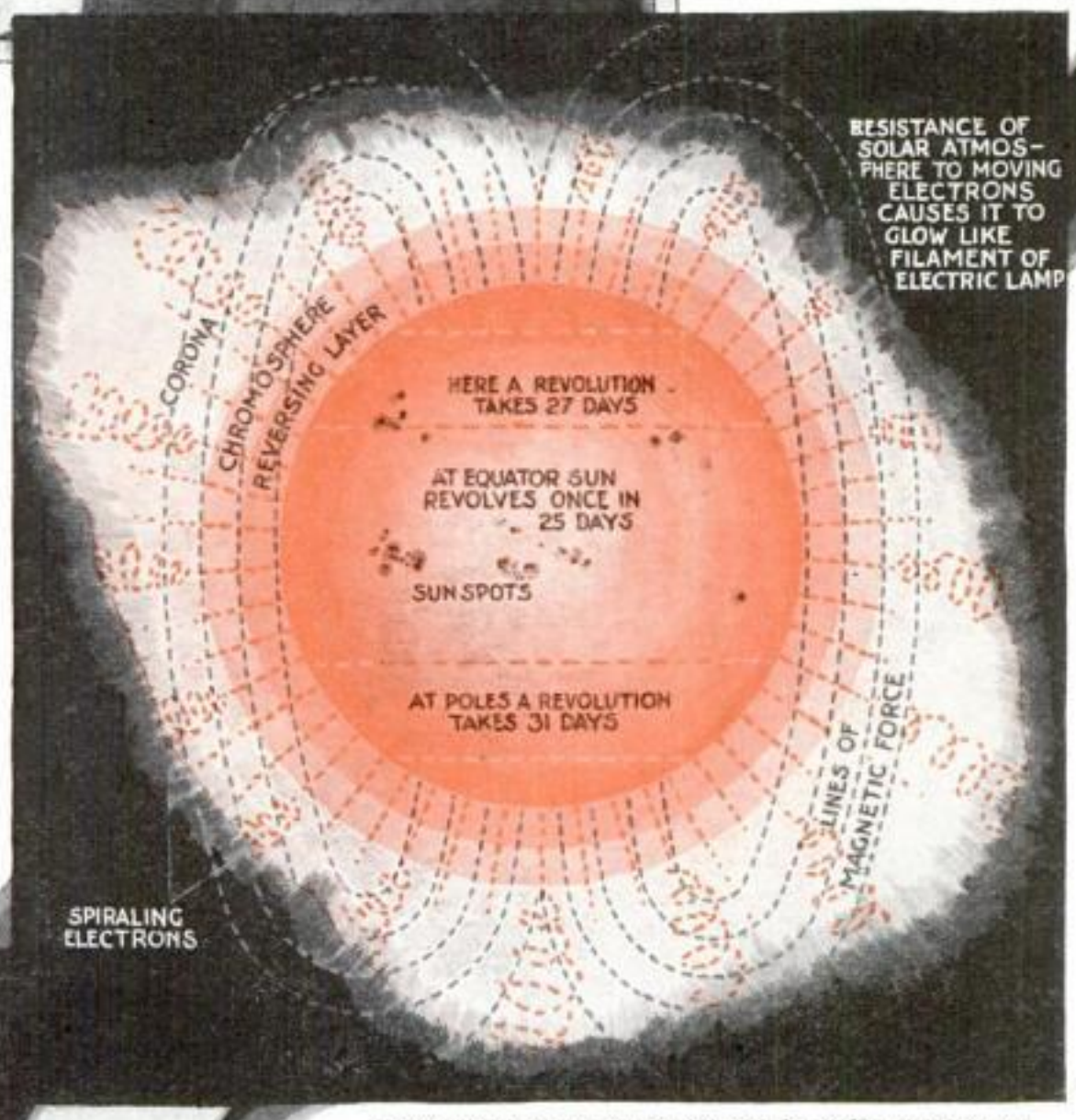


Above, at right, is the 2,500-pound "Einstein camera," carried to "Tin Can Island" and mounted on concrete pillars. In circle is picture of eclipse showing corona.



Dr. Ross Gunn, right, explains his theory of electric energy in our sun.

Streamers of flaming gas thrown from sun's surface may reach a height of 100,000 miles, as in latest eclipse.



This drawing shows the activity and peculiar behavior of the sun. Dr. Gunn's theory explains these phenomena.

which have puzzled astronomers.

A solution for another mystery of the sun is offered by the new theory. Many of the observations made at Mount Wilson indicated that the sun is a uniformly magnetized sphere like the earth, but in one respect it is strangely different. This is in the suddenness with which its magnetic force decreases as it leaves the region of the star.

If you hold a common horseshoe magnet close to a tack, the tack will leap across the intervening space and stick to the ends of the magnetized metal. But when you move the magnet farther away, the force of its magnetic attraction becomes less and less. In the case of a uniformly magnetized sphere, the strength of its pull decreases at a known rate as the distance from the surface of the sphere grows greater. By mathematical calculations, this reduction in pulling power can be determined for 100 miles, 1,000 miles, or a million miles out in space.

Such computations have been made for the sun. But, when observatory spectroscopes were trained on points a known distance from the sun, during eclipses, the result was a surprise. The shift in the lines of the spectrum showed that the magnetic force dropped off 7,000 times as rapidly as the computations indicated it should. Why? Dr. Gunn's theory offers an ingenious answer.

The electrified particles that stream into the thin solar atmosphere, he suggests, spiral many times before they collide with other particles. These whirling charges of electricity produce the same effect as a current traveling in a circle. They form a great many billion of invisible electromagnets, which are so arranged in direction as to produce an "opposing magnetic field," a great "network" of spinning electrons "holding in" or reducing the strength of the magnetic force below. This accounts, Dr. Gunn believes, for the unexplained drop in the strength of the magnetic field as revealed by the spectroscope.

The size of the current that leaves the surface of the sun and the voltage necessary to force this tremendous stream of power through the solar atmosphere have been computed by Dr. Gunn. He places the total power in kilowatts at four hundred thousand billion billion (four followed by twenty-three ciphers)—a display so vast that the output of all the generators in America, working at top speed, would compare to it as a drop of dew compares to the Atlantic.

Where does this tremendous electric current originate? What is the power house that has kept this electric light of the heavens burning for more than a million million years?

The answer to these questions, Dr. Gunn says, is to be found in subatomic conversion, *(Continued on page 136)*

Pernicious Anemia Cure Wins Our $10,000 Annual Award

POPULAR SCIENCE MONTHLY'S *Committee Selects as the Outstanding Scientific Achievement the Discovery of a Successful Treatment for a Fatal Disease made by Drs. George H. Whipple of Rochester University and George R. Minot, Professor of Medicine at Harvard.*

FIRST bestowal of the POPULAR SCIENCE MONTHLY Annual Award of $10,000 for the current achievement in science of greatest benefit to the public was made on December 18 at a brilliant gathering of the country's foremost scientists and business and industrial leaders in the University Club, New York City.

The achievement singled out for the distinction was the discovery of a cure for pernicious anemia, the dread and mysterious malady which has baffled physicians for generations and hitherto was considered incurable. The selection was made by twenty-one outstanding men of science constituting the Committee of Award.

The prize was conferred jointly upon Dr. George Hoyt Whipple, dean and professor of pathology of the School of Medicine and Dentistry in the University of Rochester, who discovered the principle of the cure, and Dr. George Richards Minot, professor of medicine in the Medical School of Harvard University, who perfected its application to human beings.

Dr. Whipple and Dr. Minot each was presented with $5,000 and a gold medal commemorating the Award.

The selection of the prize-winning accomplishment was a prodigious task. In its efforts to find the current scientific achievement of greatest benefit to humanity, the Committee of Award thoroughly covered the entire American field of scientific endeavor.

Shortly after the creation of the Award, the Committee secured the coöperation of every university and college in the country, all of the scientific societies, every industrial research organization, and various departments of the United States Government. In all, communication was established with nearly 1,800 organizations.

THESE bodies were asked to apprise the Committee of any outstanding accomplishment they deemed deserving of the Award within their own or any other field. Soon, nominations representing virtually every department of scientific endeavor began to pour in. The names of hundreds of candidates were submitted, and their number was further increased by numerous suggestions from individuals, among whom were many readers of POPULAR SCIENCE MONTHLY.

The Committee now was faced with the task of investigating the merits of each claim. This was done with the utmost care until the number of contenders was reduced to 117. It was from this number that the final choice was made.

Like many other important discoveries, that of Dr. Minot and Dr. Whipple essentially is very simple. Fundamentally, it is that a diet of liver will cure a sufferer from anemia and pernicious anemia. Working independently of each other, they both found that the organs of certain animals and birds, such as the liver, the kidney, the heart and the walls of the stomach, but especially the liver, contain chemical substances that stimulate the formation of red corpuscles in the circulating blood.

ANEMIA merely means a diminution in the red corpuscles and in the hemoglobin, which is the normal coloring matter that makes them red. It is a very common disease among human beings, and goes back as far as the history of medicine itself.

Broadly speaking, there are two forms of anemia—primary and secondary anemia. Secondary anemia is the kind which accompanies some other disease, such as cancer or tuberculosis, or which is caused by the loss of blood. As a matter of fact, anemia occurs in most chronic diseases and also in several acute ones.

Primary anemia is pernicious anemia. It is in itself a major disease and its essential cause still is one of the unsolved mysteries of medicine. Until Dr. Whipple and Dr. Minot made their discovery, a diagnosis of pernicious anemia in the vast majority of cases amounted to a death warrant for the patient.

It was Dr. Thomas Addison, the famous British pathologist, who first noted and studied the disease. Eighty-one years ago, he described its symptoms and progress thus:

"The whole surface of the body presents a blanched, smooth and waxy appearance; the lips, gums and tongue seem bloodless . . . appetite fails. Extreme languor and faintness supervene, breathlessness being produced by the most trifling exertion or emotion. . . . The patient can no longer rise from his bed, the mind occasionally wanders, he falls into a prostrate and half-torpid state, and at length expires."

And for this dreadful malady there was no known cure. The situation that prevailed from the time Addison wrote his description until Dr. Whipple and Dr. Minot perfected their methods of treatment may be summed up in this terse statement by a New York physician:

"Nothing can be done for a pernicious anemia patient except to make him as comfortable as possible."

NOW all this has changed. Today pernicious anemia is curable. By taking it, once for all, out of the class of incurable diseases, Drs. Minot and Whipple have conferred a boon upon mankind.

Briefly, the problem confronting the medical world was this: What will stimulate an increased formation of red blood cells?

The manner in which these two men set about to solve it constitutes one of those unheralded but thrilling battles with death in which the romance of medicine abounds. They arrived at virtually the same point by traveling widely different roads. Dr. Whipple's investigations were of the experimental or laboratory variety; the work of Dr. Minot, a practicing physician, was clinical and practical.

Dr. Minot first attacked the problem in 1913, when, twenty-seven years old and recently graduated from the Harvard Medical School, he served his interneship at the Massachusetts General Hospital in Boston, and began the special study of the diseases of the blood that was to become his life work. But it was not until eleven years later, in 1924, when he was back at the Massachusetts General Hospital in charge of a special clinic after various connections with the Harvard Medical School and the Johns Hopkins Hospital in Baltimore, Md., that he developed his liver treatment.

Dr. Whipple began his experiments thirteen years ago when he was professor of research medicine at the University of California, at Berkeley, California. The results of his work did not become known to the medical world at large until 1922, while those of Dr. Minot's activities were made public only as recently as 1926.

Dr. George Hoyt Whipple

Dr. George Richards Minot

Obverse of gold medal presented to the winners of $10,000 honor award.

Reverse side of Popular Science Monthly's medal which bears inscription.

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ORVILLE WRIGHT
Scientist and Inventor

THE first step in Dr. Whipple's experiments was to raise a number of dogs in his laboratory kennels. Dogs have the same blood count as human beings, meaning that a normal dog, like a normal man, has from 5,000,000 to 6,000,000 red corpuscles per cubic millimeter of blood. He gradually bled the dogs down to about one third the normal count, thus inducing severe anemia, and kept them in that condition for the rest of their lives. Some of the dogs remained anemia "patients" for six years.

In this state, the animals reacted sharply to various diets they were fed, offering Dr. Whipple the opportunity to ascertain what kinds of food, if any, would cure anemia. A large number of foodstuffs were tested in that way over a number of years.

As a result, Dr. Whipple found that liver was by far the most powerful and quickest factor in stimulating the production of red blood cells. But it must be liver from mammals or birds. Fish liver, the tests showed, contains only a trace of the chemical that restores red blood.

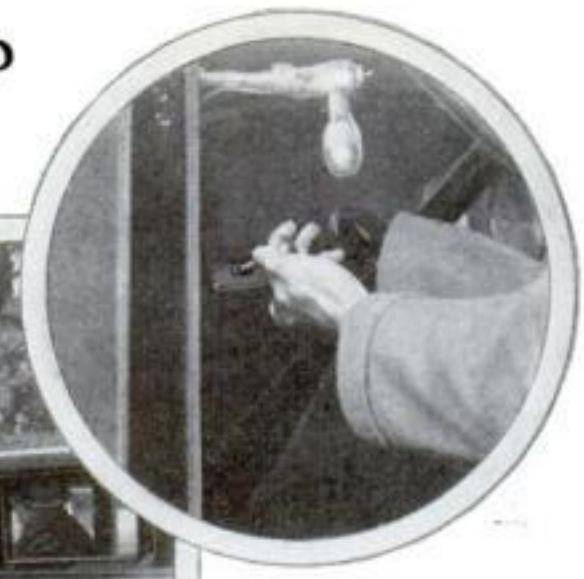
Kidney and chicken gizzard come next, being about three fourths as effective as liver. Sweetbreads are about half as beneficial as kidney. Steak rates low, with only half the effect of sweetbreads, or one fifth that of liver.

Bread, grains, milk, and cheese were shown to have very little value in fighting anemia. On the other hand, certain fruits, such as apricots, peaches and prunes, are surprisingly helpful, possessing about half the potency of liver.

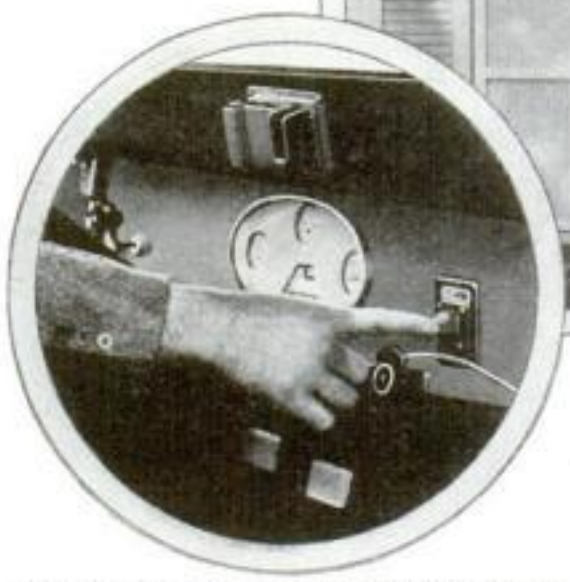
To realize fully *(Continued on page 122)*

Widely Separated Inventors Develop Systems to Open Garage Doors with Radio Impulses

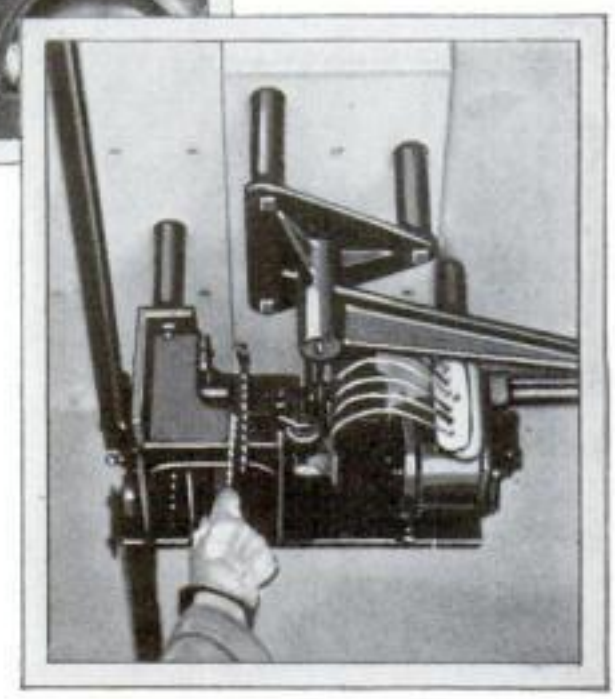
Your garage doors are opened by radio as you drive up when this device, invented in Spokane, Wash., is used on the garage.



An Illinois firm developed this system which opens the doors when knob is pulled.



Pressing the button on the instrument board of your car releases impulses to open doors.



Close-up of the safety mechanism that stops doors, when moving, if they strike a person.

WHEN you drive home late at night, there is no need to step from the car into a cold wind or a driving rain to open the garage doors. Instead, touch an inconspicuous button on the instrument board of your car—and radio opens the doors for you.

Perfection of the new radio door opener is announced simultaneously by an Illinois manufacturer and by a pair of Spokane, Wash., inventors as another evidence of coincidence in real life.

When the driver pulls out a knob at the left of the cowl and lets it go, in the Illinois system, a timer in a small box beneath the instrument board starts to send coded electric signals. Stepped up to high voltage for transmission by a spark coil in a watertight case on the car's frame, they are "broadcast" as a radio message in code by an antenna—two insulated wires beneath the car.

As if by magic, the doors swing open and the light at the garage door is automatically turned on. The radio signals have been picked up by a second antenna buried in the driveway, and actuate a one-tube receiving set and electric control similar to a device that railroads use for automatic train control. Electric motors open the garage doors, which lock in the open position. When the car is in the garage, another touch of the radio button closes the doors. A person standing inadvertently in the way of the opening or closing doors cannot be hurt, for an "overload release" automatically stops the motors if the doors strike any object, and must be reset by pulling a chain before it will work again.

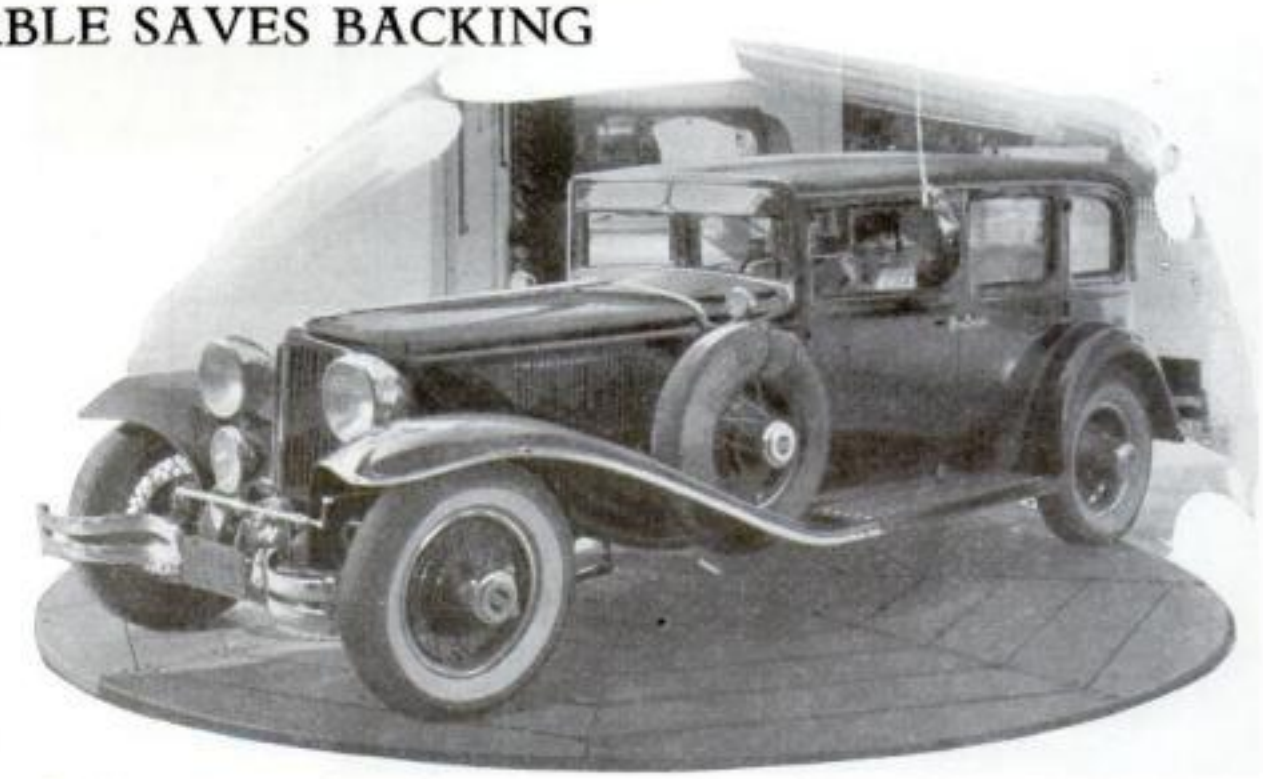
Closely resembling this system, outwardly, is the radio door opener devised by the Spokane inventors. The control button, at the right of the instrument board, is pressed to operate the doors. The principal difference, however, is the method of protecting cars from possible theft. It depends upon having the receiver tuned to respond only to the particular wave length broadcast by the spark coil on the car, instead of to coded radio impulses. Of course with a wave length check, it would be possible to tune through and eventually find the right wave to open the doors. With a code system there would be no chance to activate the control without discovering the right code, a practically impossible task within the time limit that a car thief could give himself.

THIS AUTO TURNTABLE SAVES BACKING

BACKING into and out of garages in small suburban homes may be eliminated by an automobile turntable that swings a car around in its own length, just as locomotives are handled at railway roundhouses.

A revolving platform large enough to take standard-sized pleasure cars is controlled either by hand or electric power. When electric drive is used, it is operated by a push button on a cord suspended over the table, just as an electric light is turned on in the house. The driver can operate the table in this manner without getting out of the car. The table makes but one half revolution before stopping.

Should hand operation be desired, the apparatus is so perfectly balanced and according to its inventor turns so easily that a child can operate it. Use of it is said to have solved many problems of garage design where the building has to be placed on small lots.



Backing your car out of a small yard is unnecessary if one of these small turntables is installed. It is operated easily by hand or its mechanism can be hooked up and run by electricity.

FLUTE, 20,000 YEARS OLD, FOUND IN NEVADA CAVE

WHO played on a pair of flutes found recently in Gypsum Cave, Nevada? Students of primitive man say these flutes, and small darts called "atlatl" found with them, are the most important ethnological discoveries ever made in America. In the opinion of M. R. Harrington, curator of the Southwest Museum, they prove that human beings lived in America 20,000 years ago and had developed even then a distinct culture.

SCREW CAP CONNECTS ELECTRIC WIRES

JOINING ends of electric wires without solder or tape may be done with a handy new screw cap made of molded composition with a threaded metal core. Insulation is scraped off the wires, which are held together parallel to each other, and the cap is screwed over them. Threads on the inside of it cut into the soft copper wire, gripping it securely and making contact. It can be put on or taken off as easily as a nut is screwed on or off a bolt.

This insulated cap screw joins electric wire ends quickly by firmly screwing into copper.

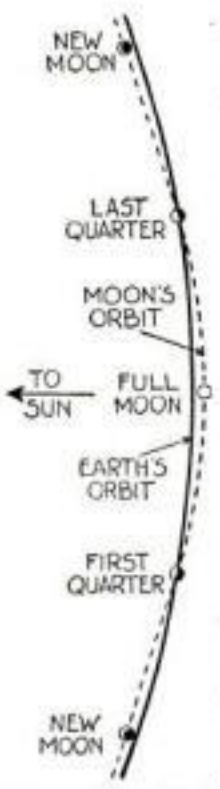
UNCLE SAM HAS RAILWAY IN ALASKA AND PANAMA

OF ALL railways in the United States and its possessions, the one farthest north is in Alaska and the one farthest south is in the Isthmus of Panama, and both are owned by the United States Government.

The Alaska railroad, put in operation in 1925, runs to within 120 miles of the Arctic Circle. Seward and Fairbanks are the terminal points of its 470-mile main line, over which trains make three round trips weekly during the summer season. As yet this railway, which cost its owner $60,000,000, has not been a financial success.

The Panama railway, forty-seven miles long, was built before the Civil War as a link in the transportation chain between the Atlantic and Pacific coasts. Many "Forty-niners" found it convenient to use this railroad in making the trip to California. The road has always been a financial success. During the first ten years of its existence it carried $700,000,000 worth of gold and 300,000 bags of mail.

DOES THE MOON GO ROUND THE EARTH?



IF OUR world were stationary in space, the moon would travel in a nearly circular path around us. However, both the earth and the moon are rotating around the sun and the actual path of the moon through space is, therefore, a circle made with a wavy line much like the path of a snake traveling around in a circle.

Furthermore, if you plot the orbit of the earth round the sun to a scale which will make it 400 inches (thirty-three and one third feet) in diameter, the orbit of the moon would be only one inch. At no point would the plotted path of the moon be convex toward the sun.

Speaking in the absolute sense, the moon doesn't revolve around the earth at all. It revolves around the sun in company with the earth.

And if you wish to dig in still deeper, you will find that the sun together with all the planets is traveling through space as a unit at tremendous speed. To an observer on another star the moon's path would appear to be a complicated sort of a spiral. The shape of the spiral would depend on which star the observer chose as an observation point.

BIGGEST ROLLER BEARING WEIGHS 3½ TONS

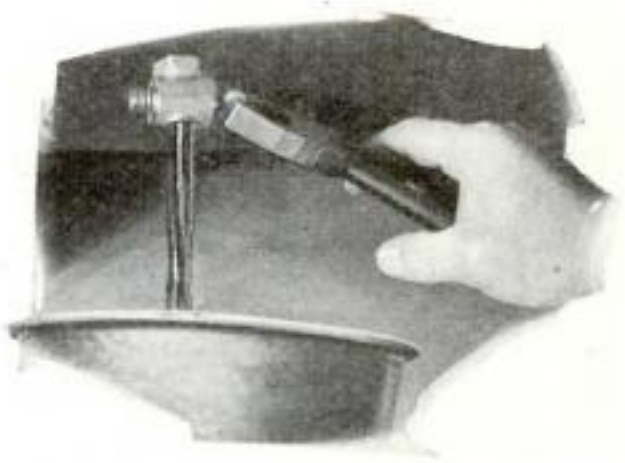
LARGEST of its kind, this huge roller bearing could carry more load without crushing than a 100-car freight train. It has just been completed, along with twenty-seven others like it, for an immense steel mill. The monster three-and-one-half-ton bearing will support rolls that crush steel bars into thin plates, it is claimed by the makers.

By way of contrast, the young woman in the picture holds a standard seven-ounce roller bearing designed for an automobile wheel, thus giving an idea of the size of the giant roller.

VALVES FOR CRANK CASE EASILY DRAIN OIL

DRAINING the oil out of your car is made easy by a new valve that screws into the hole at the base of the crank case in place of the nut with which most cars are provided. The valve is turned easily with a pair of pliers.

The new valve is sufficiently short to clear any bumps in the road and rugged enough to escape damage from flying pebbles thrown by the wheels. It is made in sizes threaded to fit nearly all makes of cars and is easily installed.



To facilitate the task of draining oil out of your car, this valve fits into the crank case.

"SKI HOPPING" IS STUNT FOR EXPERTS

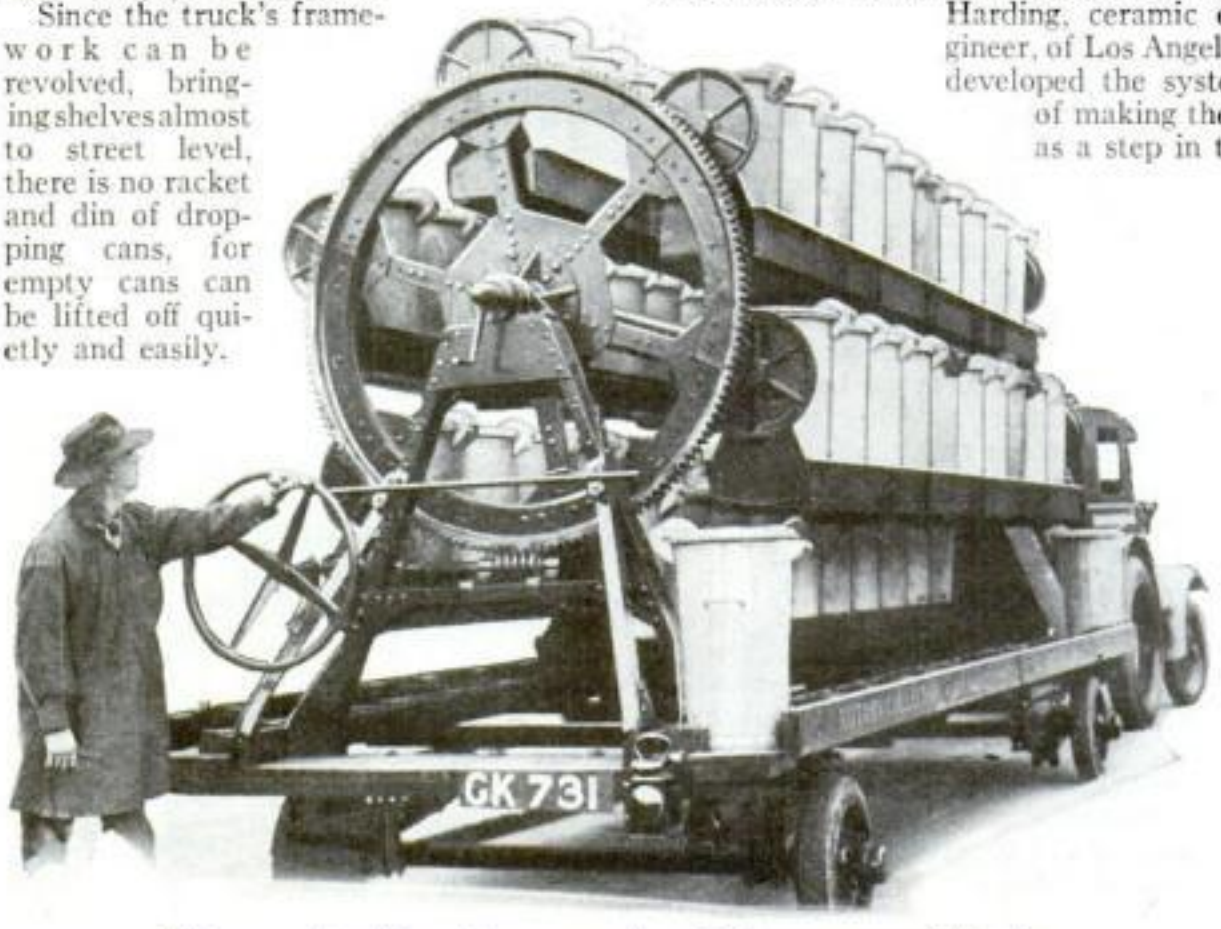
Hopping gaily from crag to crag on skis is a new Alpine sport that only the most expert can hope to enjoy.

LEAPING like running deer, expert skiers at St. Moritz, Switzerland, recently gave an exhibition of progress in a series of springy jumps, called "ski hopping." Ordinary travel over open country with skis is difficult, but to maintain a speed that enables the user to take off in short successive jumps calls for skiing ability of an unusual degree. Only experts can practice the sport of "ski hopping." In the photo above all four skiers are in the air.

SQUIRREL CAGE TRUCK COLLECTS ASH CANS

STRANGE looking trucks have been designed in London, England, for removing ashes and refuse in a quiet and sanitary manner. A rotating framework carries shelves that work like cars on Ferris wheels, on which ash cans are stacked. These are of special design, having securely fastened covers. When they are filled the cover is closed and fastened and the truck removes the entire can to the dumping grounds, leaving a sterilized "empty" in its place.

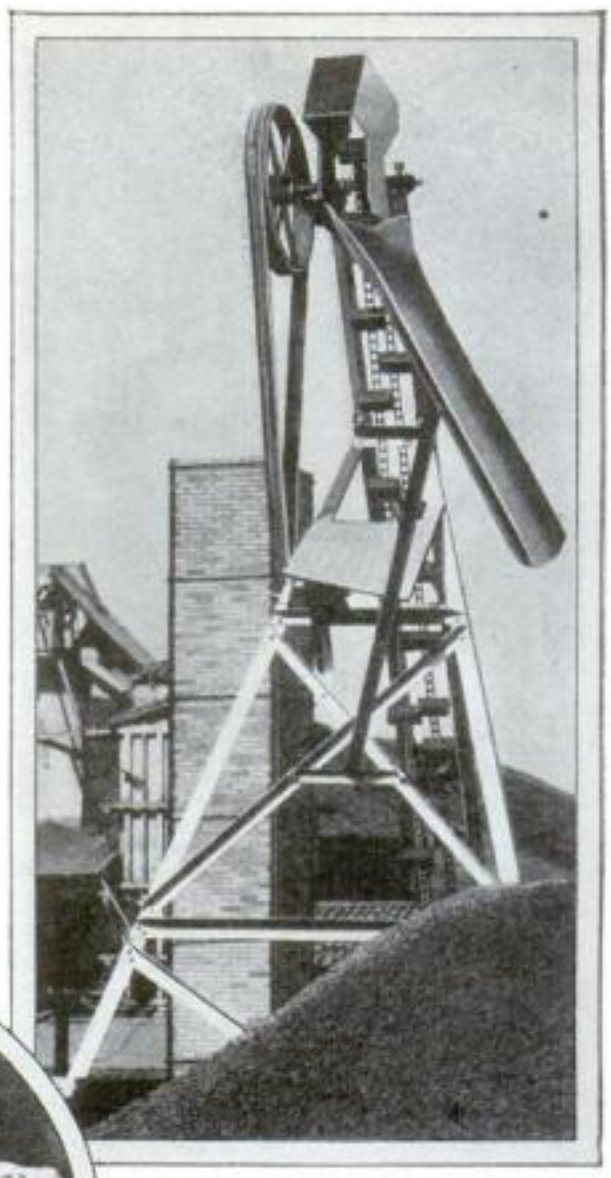
Since the truck's framework can be revolved, bringing shelves almost to street level, there is no racket and din of dropping cans, for empty cans can be lifted off quietly and easily.



This unusual truck for ash cans recently made its appearance in London. The carriage revolves for loading but the cans are always right side up.

MAKES MILLION BALLS A MINUTE IN ROTARY KILN

A MILLION hollow clay balls a minute are turned out in a California pottery works that uses what is believed to be the largest rotary kiln in the world. Dr. Knox Harding, ceramic engineer, of Los Angeles, developed the system of making them as a step in the manufacture of a new style of building brick. The finished bricks are one sixth as heavy as common ones without sacrifice of strength, according to Dr. Harding. After baking, the bricks go from the kiln, at left above, to the elevator, where they are annealed while going up and cooled as they drop from the chute.

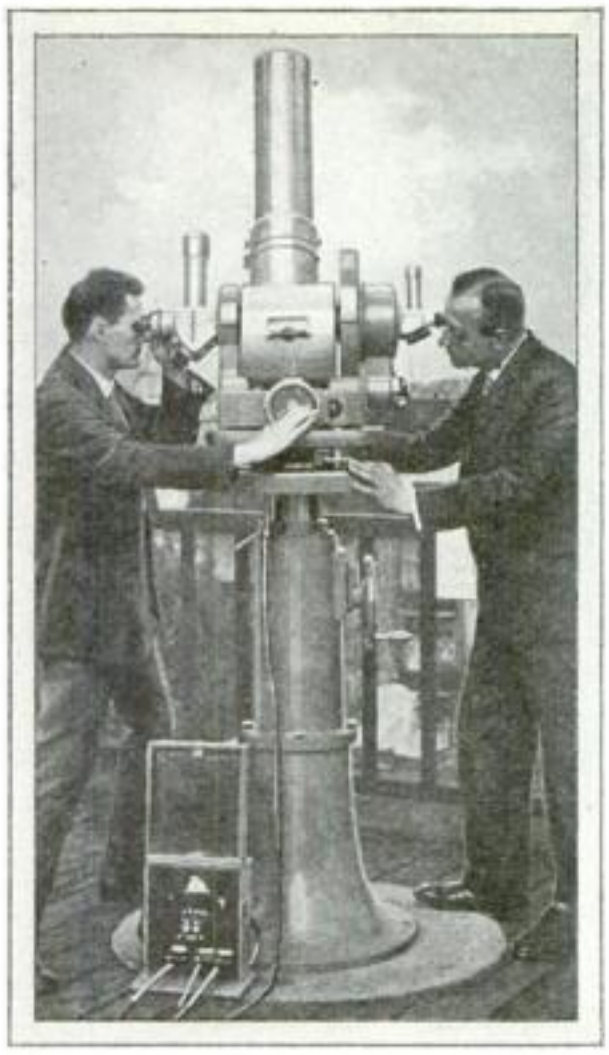


A million clay balls a minute are made in this rotary kiln which is turning out a new kind of brick developed by a Los Angeles engineer.

FOLDING NINE-INCH RULE IS PART OF NEW KNIFE

A USEFUL pocket tool for "handy men" and mechanics is this knife into which a measuring scale has been built. Besides two standard large and small knife blades, it contains leaves that unfold to make, together with markings on the knife's back, a nine-inch measuring scale. One side is graduated in inches, the other in centimeters.

Leaves that fold inside the handle of this knife will open up to form a nine-inch measuring gage.



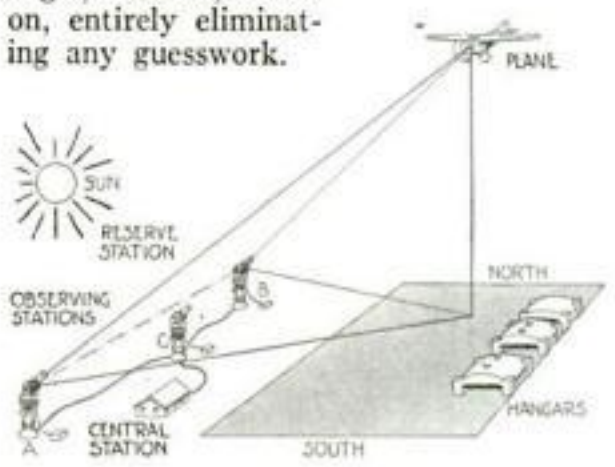
Cine-theodolite trained on plane to take four pictures a second while it is being test-flown.

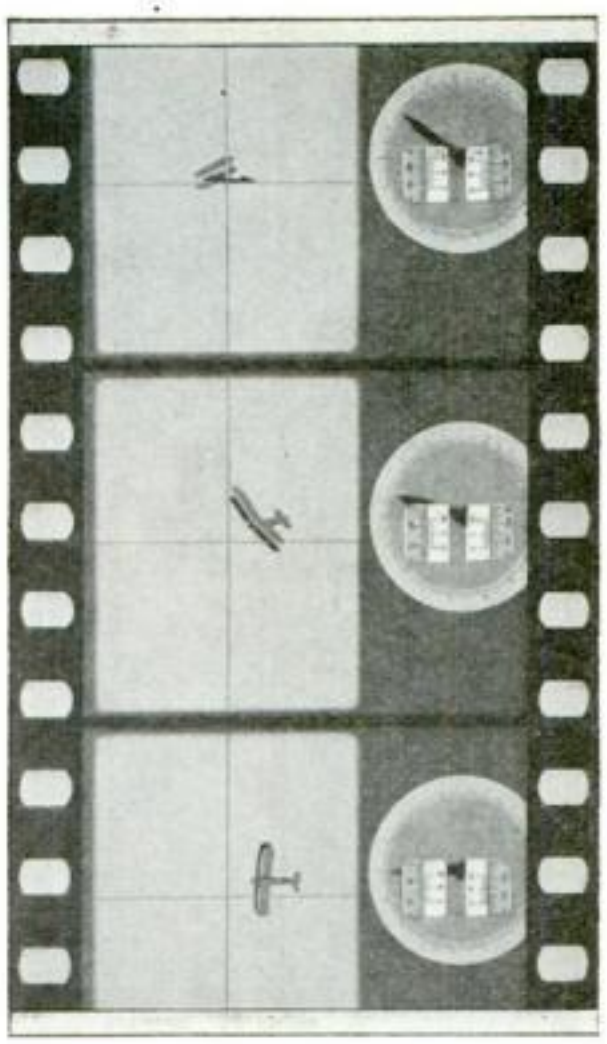
PLANE TESTS CHECKED BY INSTRUMENT ON GROUND

A NOVEL German instrument which combines movies and telescope is now in use in Germany to make a record of every feature of an airplane test flight.

Three of the instruments are set up and kept focused on the plane during the test. Exposures at the rate of four to the second produce a film record that indicates the exact position of the plane during every instant of its flight.

In this way the speed of the plane in flying from one point in the air to another can be accurately determined. Any test evolutions the plane performs can be plotted with equal accuracy as to position, angle, distance, and so on, entirely eliminating any guesswork.





A section of film made by cine-theodolite showing position of plane at various angles.

ALUMINUM STRONGER IN GREAT COLD

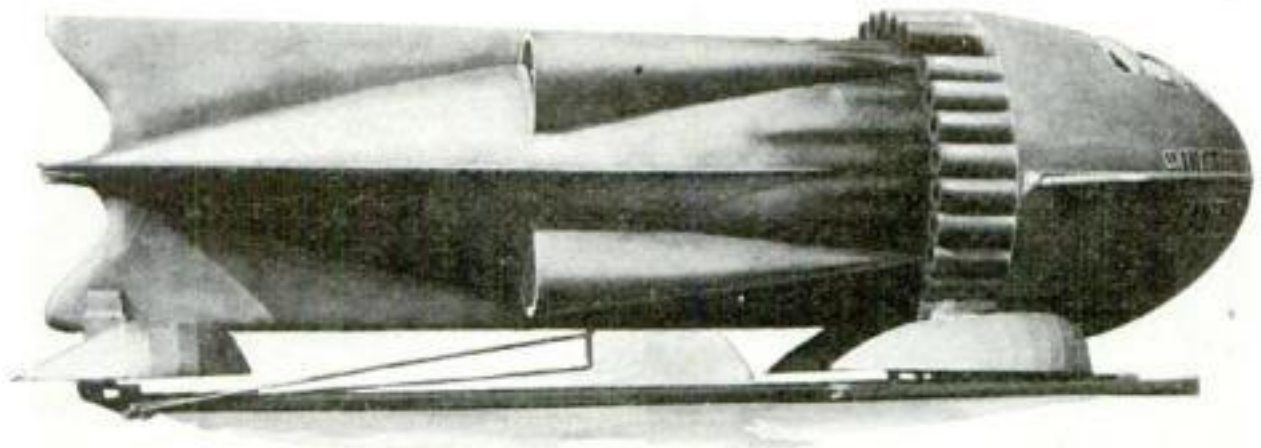
IN THE bitter cold of high altitudes at which some airplanes operate, aluminum becomes stronger than in warm surroundings. This was the odd conclusion reached when samples of the metal, widely used in aircraft construction, were recently tested at seventy-five degrees Fahrenheit, and then at a temperature of 112 degrees below zero, in a Pittsburgh, Pa., metal manufacturer's research laboratory.

One sample of duralumin, an alloy in which aluminum is used, showed an increase in strength of almost three percent when given the cold test. This means that if it broke under a load of 1,000 pounds at a temperature of seventy-five degrees, at 112 below zero it would stand an additional load of thirty pounds.

Some samples tested showed an increase in strength of eleven percent.

AIRPLANES OF FUTURE MAY LOOK LIKE THIS

WHAT will the airplane of the future look like? When a Los Angeles, Calif., movie engineer was asked to design such a craft for a scenario, he produced this remarkable model. He visioned the aerial vehicle of a coming age as a craft driven by rockets, of which the tubes may be seen projecting near the bullet-shaped head. The body is streamlined, as if for a high-speed jaunt of a thousand miles an hour through the thin air of outer space several miles above the surface of the earth.

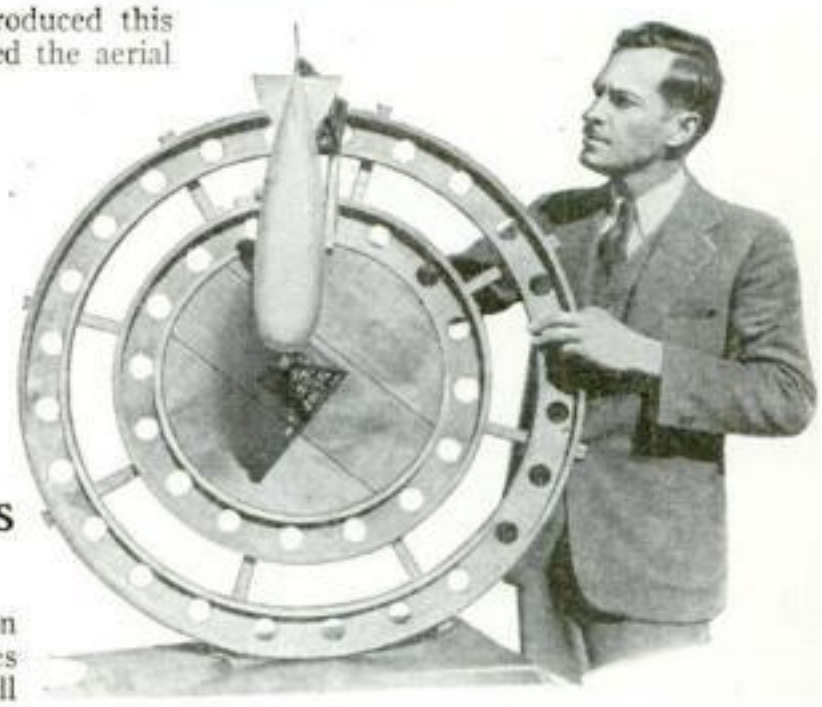


Will airplanes of the future look like this? A Los Angeles engineer made this model to show possible design of high speed rocket driven aircraft.

TREASURE SEEKERS STILL ACTIVE

THE glitter of gold sunk on tropic ocean floors centuries ago in Spanish galleons still attracts treasure seekers.

Reports from Spain show that last year alone more than 5,000 people made the trip to old Madrid from all parts of the world for the express purpose of searching old government documents for clues to the possible locations of wrecks of gold ships sunk long ago.



NEW AIRSHIP MAST LETS TAIL SWING WITH WIND

A METHOD of docking large dirigibles by use of two mooring masts is the invention of Dr. Alfred Lee Wilkes, of Los Angeles, Calif. An airship's nose is brought down to a bow mooring mast, while the other mast, to which its tail is secured, moves around it on circular tracks. Automatic control of machinery which actuates the movable mast insures that the airship will lie head to wind at all times, while its tail is held from veering wildly in gusty winds. This tendency to veer has caused several near-accidents in the past. The inventor believes smaller ground crews will be able to handle large airships easily by using his equipment.

The illustration above shows how the tail of the dirigible could swing in a circle toward any point of the compass while the nose would remain fixed to a point around which the craft could rotate.

Seek Airports in Arctic Ice

Flying route to Europe may cross ice fields of Greenland—Dynamite used to blast path as explorers seek site for airplane landing field on frozen plateau

Members of the exploring expedition stopped on the edge of a crevasse in the Kamarujuk glacier.

At upper right, one of Wegener's ponies is hoisted from ship to Greenland's shore. At right, dogs were often forced to leap the crevasses that make travel dangerous on big glacier.

WILL the first successful air route to Europe cross Greenland ice, as Vilhjalmur Stefansson, famous polar explorer, and many air experts have suggested?

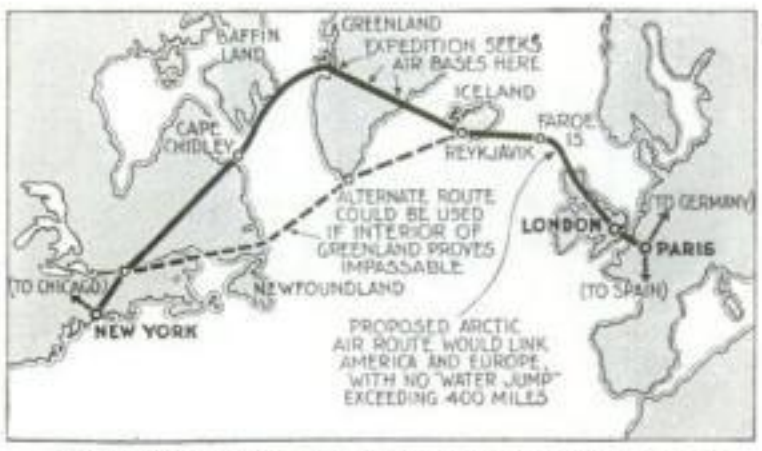
To determine whether an Arctic air line is practicable, a party of German explorers led by Prof. Albert L. Wegener, noted geologist, is spending three months on the trackless ice sheet that covers Greenland. They seek to find out how thick it is, how it got there, and whether anyone can live on it, walk on it, and land on it in an airplane. Split in three groups, the expedition is exploring the east coast, the west coast, and the high ice plateau of the interior.

If landing places for planes can be found there, the last-needed link will be added for an airway that can span the Atlantic in jumps of less than 400 miles, as the accompanying map shows. Elsewhere along the route, landing fields are already established.

Besides the investigation of air line prospects, the Wegener expedition is studying the physical nature of the ice cap and its glaciers. Elaborate weather observations are being made with the aid of captive balloons, sent to heights as great as seven miles. These data will be supplemented by records secured by a British surveying expedition, also in the field.

The Germans introduced an innovation in Arctic exploring when they recently put into commission two motor-driven sledges with air propellers, which roar across smooth ice at fifty miles an hour. Each, at last reports, had made two dashes to the inland depot, 124 miles from the sea, with loads of 1,000 to 1,200 pounds.

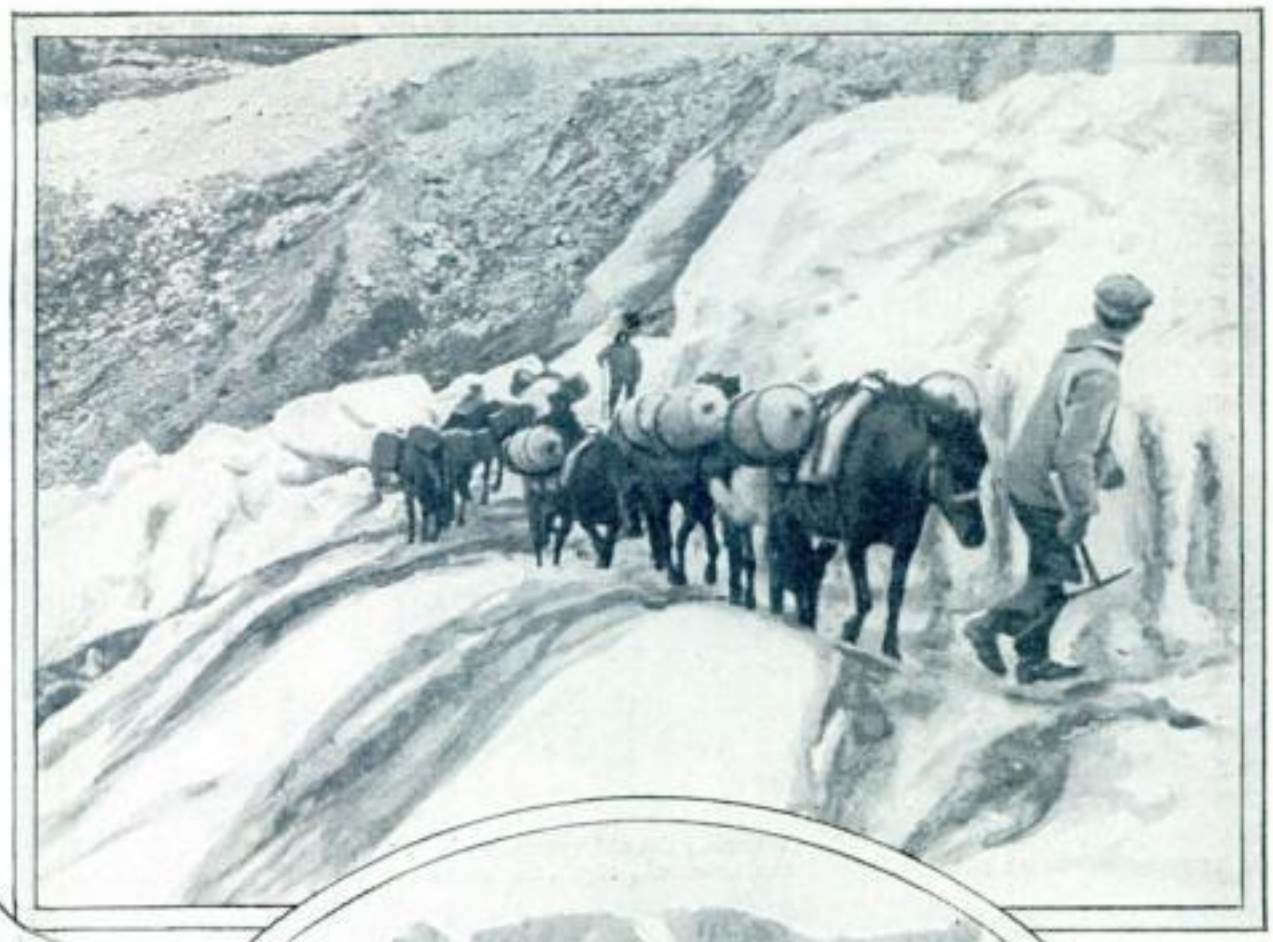
When the going is bad, however, only dog teams and heart-breaking toil can get the supplies through. In order to ascend the treacherous Kamarujuk glacier, on the west coast, it was necessary to blast a path with fifty charges of dynamite. As the ice reflects sunlight, it was sprinkled with soot so it would absorb the sun's warmth, which would melt it.

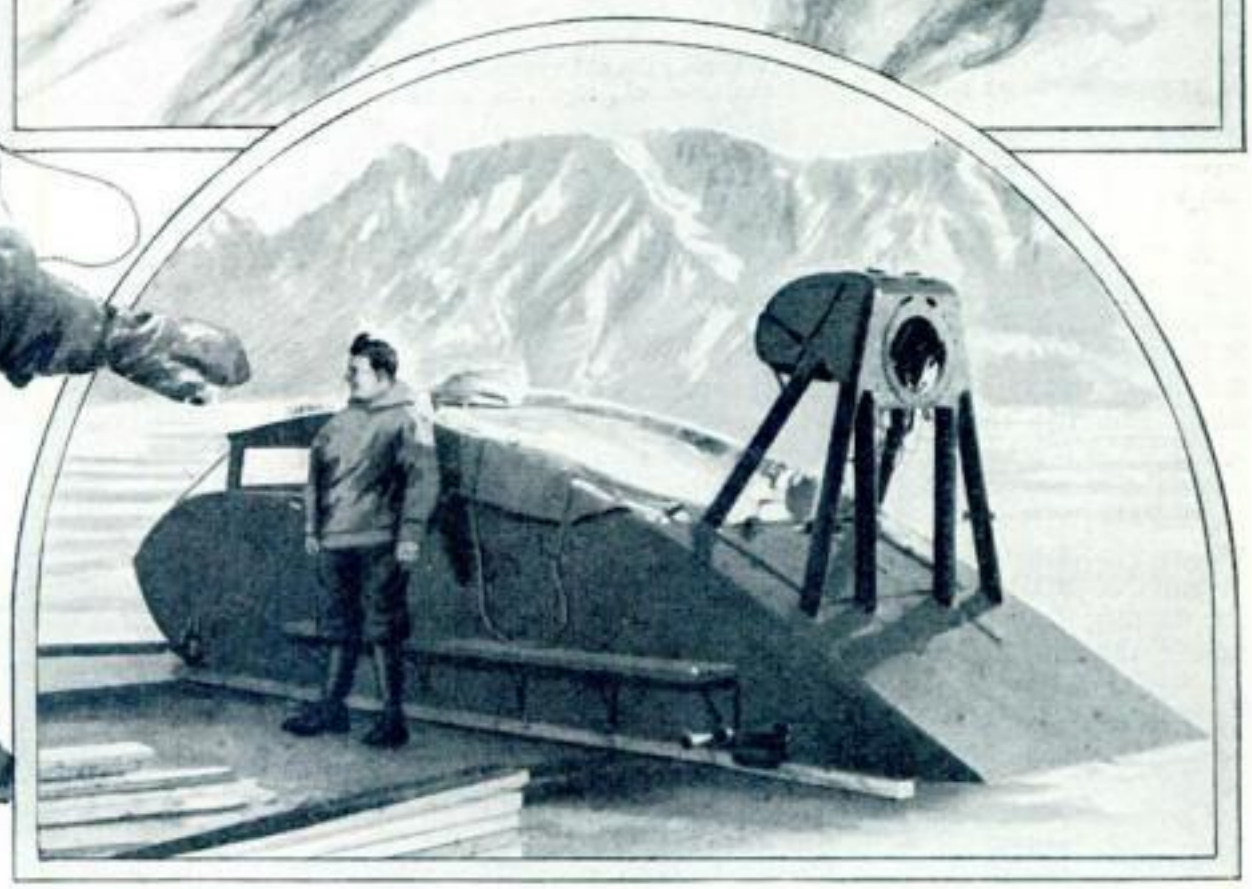


Map shows proposed America-Europe air line crossing Greenland with 400 miles as longest water jump.

Prof. A. L. Wegener, German explorer and geologist, head of Greenland expedition.

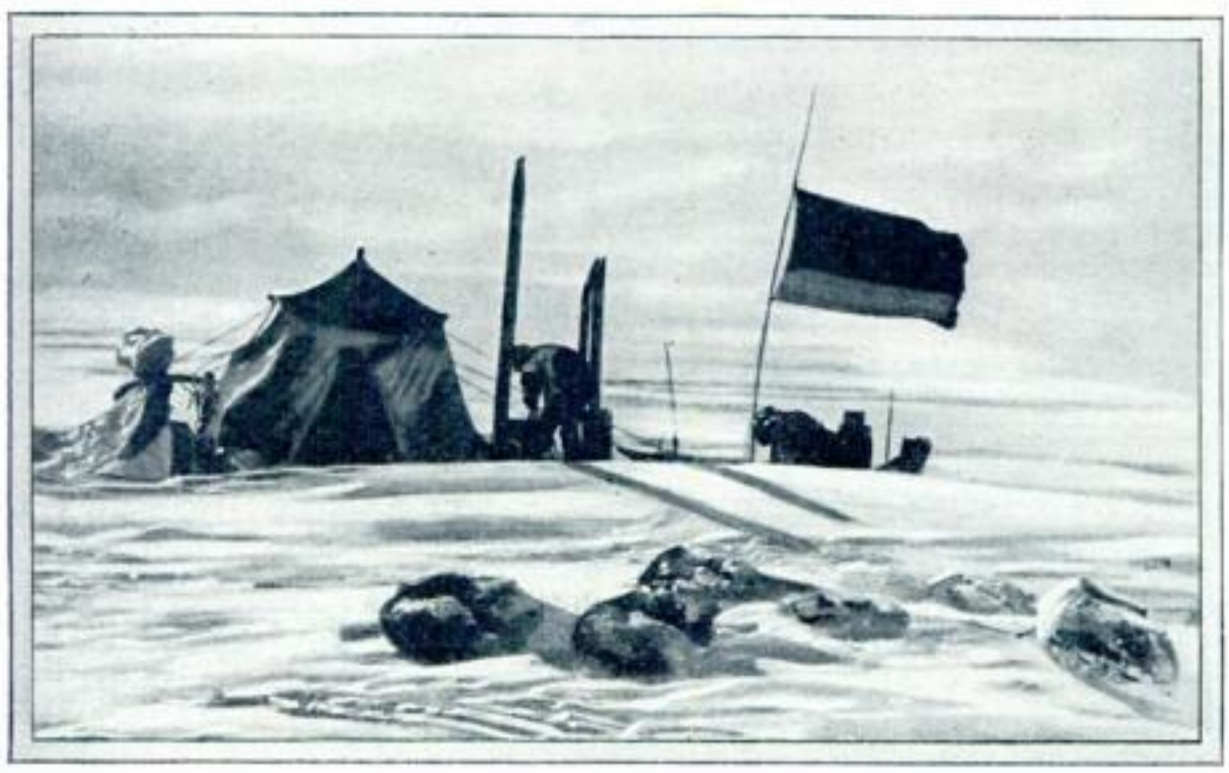
Right, dynamite blasted a way up the glacier, so that ponies could carry gasoline for the motor sledges. Note use of soot to melt ice.





The last word in Arctic exploration. Here is one of the expedition's two air-propelled motor sledges, raised by windlass to this sheet of ice, across which it can whiz at 50 miles an hour.

Sledges packed high with food and scientific instruments were dragged, sometimes by the men, into almost inaccessible frozen deserts.



In the bitter cold of this wind-swept plateau, everything froze solid, including the flag, as can be seen in this picture. This hut stands on an icy upland that is 8,000 feet high.

Drilling into Greenland's ice. Wegener's expedition is seeking to learn the thickness of the ice cap in this little-explored region.

AMERICAN ARMY GETS TALKING GAS MASK

THE latest development in antigas equipment in the United States Army is a mask through which the wearer can talk. It permits him to use his voice to keep in touch with his comrades, instead of muffling him as have all other masks in use up to the present.

A diaphragm carries his voice outside the device, while preventing gas from entering it. In testing out the new apparatus wearers carried on telephone conversations easily and distinctly. The masks are expected to prove a benefit to scouting parties which must keep in constant communication by telephone with main bodies of troops in a gas attack.

Wearing the old gas mask, left, a soldier could not talk. With the new one, right, he can carry on conversation in safety.

NEW METHOD MAKES HARD COAL IN FEW HOURS

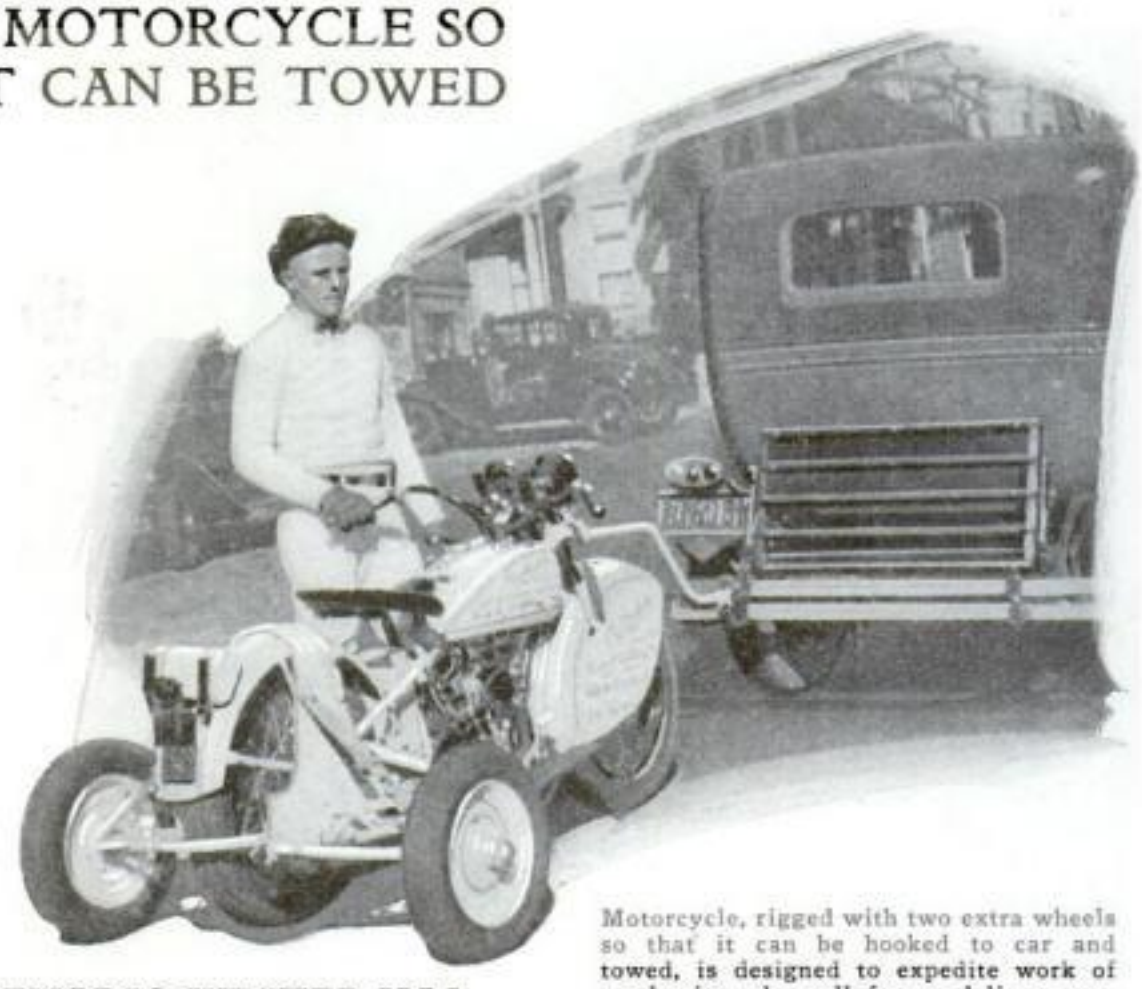
NATURE requires millions of years to make hard coal, but engineers in Chicago, using an entirely new process, are making it out of soft coal in a few hours. This achievement will make "synthetic" hard coal available for industrial use, which in turn will result in cleaner cities and factory districts, for the new fuel is said to be smokeless. Valuable by-products are extracted and used, instead of escaping up chimneys as waste matter as they do at present.

Soft coal, in the course of this process, is made to part with its moisture and two thirds of its volatile or smoke-forming matter. About 1,400 pounds of "char," the left over material, is obtained from a ton of soft coal. This is ground to a powder, mixed with a petroleum binder to make it stick together, and compressed into briquettes. The plant just put into operation in Chicago is the first of a series to be erected throughout the country.

TWO EXTRA WHEELS ON MOTORCYCLE SO IT CAN BE TOWED

A MOTORCYCLE with two small additional wheels that can be lowered, so the machine can be towed behind a motor car, is the novel idea of a San Francisco automobile company. The job of calling for and delivering cars is facilitated by its use, for the mechanic delivering a machine tows the motorcycle behind it.

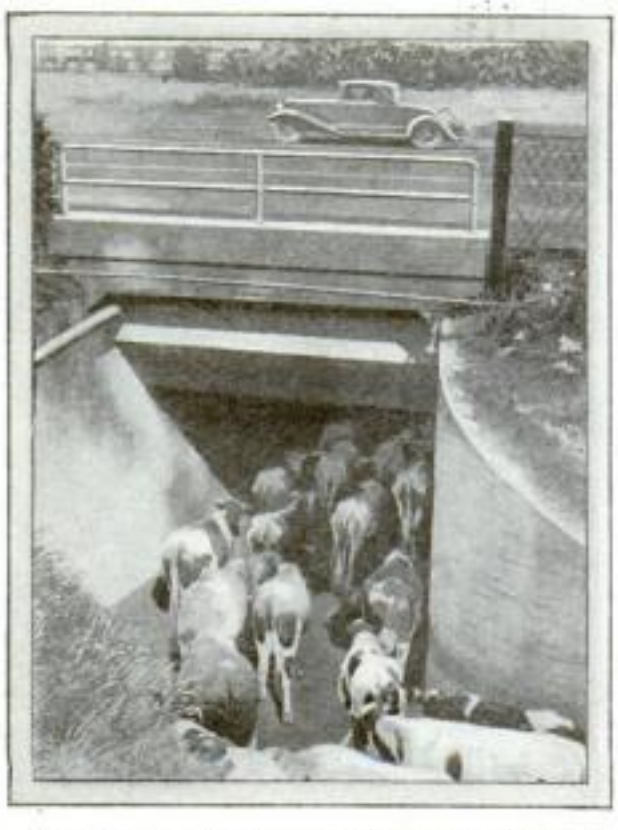
A special frame is fitted to a motorcycle that is standard in other respects. When the small side wheels are dropped for towing they automatically raise the power wheel off the ground.



Motorcycle, rigged with two extra wheels so that it can be hooked to car and towed, is designed to expedite work of mechanics who call for or deliver cars.

COWS GO TO PASTURE THROUGH A SUBWAY

Cows in a California dairy get to and from their work by subway. A traffic-crowded highway lay between the dairy buildings and the pastures, constantly endangering the cattle when they crossed it. In order to safeguard the animals a cement-lined tunnel was built under the road for the exclusive use of the cows.



To keep his cows out of highway traffic, a dairyman built a subway to their pasture.

SCENARIO WRITER HAS PLOT MAKING ROBOT

A MECHANICAL robot that turns out plots for brain-fagged authors is the invention of Wycliffe A. Hill, Los Angeles scenario writer. Christened "Shakespeare's ghost," this device is said to produce a complete outline of a fiction story in twenty minutes, to an accompaniment of whirring gears. It selects background, characters and dramatic situations from a series of tapes.

MAY STRING VIOLIN BOW WITH SILVER THREADS

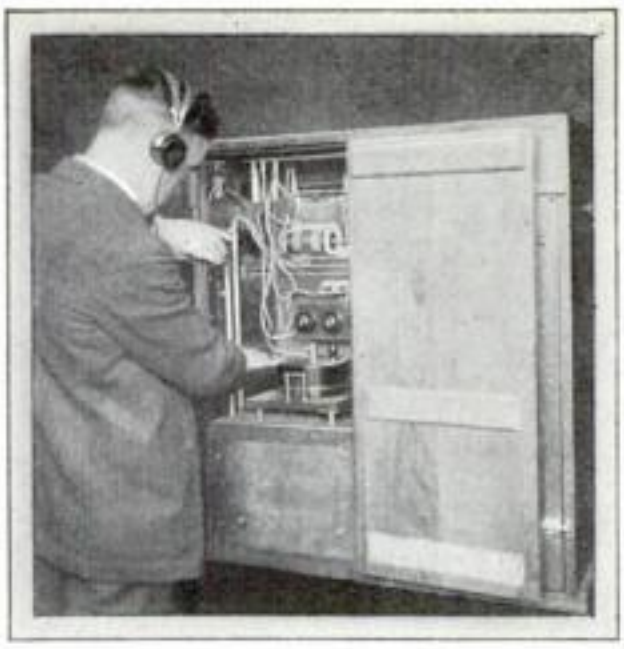
HORSEHAIR, which for hundreds of years has been used for stringing violin bows, may soon give place to another material. A German violinist has been experimenting with bows strung with fine silver wire that has been slightly roughened. Great sensitiveness and brilliance of tone are achieved, it is said, with the new strings.

RESEARCH TRIES TO FIND CAUSE OF GRAY HAIR

GRAY hair and baldness recently came in for special attention by scientists.

In New York City, sixteen barbers have been enlisted by Dr. Nicholas Michelson, acting for Columbia University's department of anthropology, to aid in collecting samples of gray hair from their patrons. The object is a survey to find how the graying of the hair is affected by age, sex, and occupation. Barbers receive five cents for each specimen lock shorn from a customer's temple and submitted, with appropriate data, for a microscopic examination.

Meanwhile, a cure for one special type of baldness was reported to the American Chemical Society by Dr. C. N. Myers, of Brooklyn, N. Y. He described a drug known as sulfactol, which had proved efficacious in helping a rare malady in which hair falls out in localized areas.



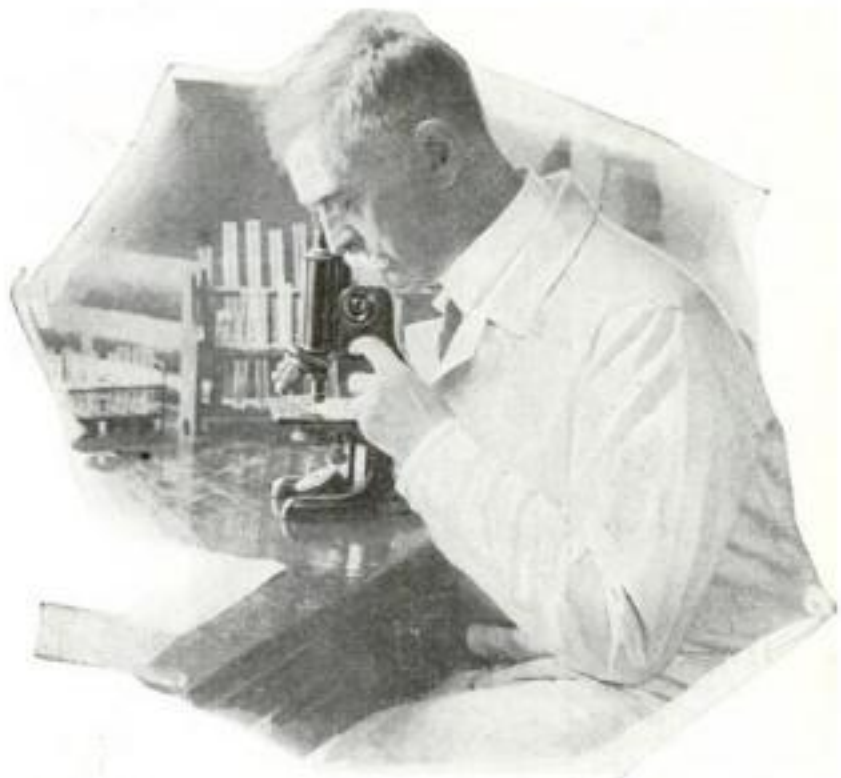
INSTRUMENT MEASURES SALT IN WATER

SO SENSITIVE that it can measure to within fifty milligrams—about the weight of a postage stamp—the amount of salt in a gallon of sea water, an electrical device developed by the U. S. Bureau of Standards has no equal in the world.

Its practical use is in determining the direction of ocean currents, which may be traced by slight differences in their saltiness. Coast Guard boats on ice patrol, employing the instrument, can tell in which direction icebergs are drifting even when fog prevents actually sighting them. The new instrument does its job by measuring the ability of the water to conduct electricity.

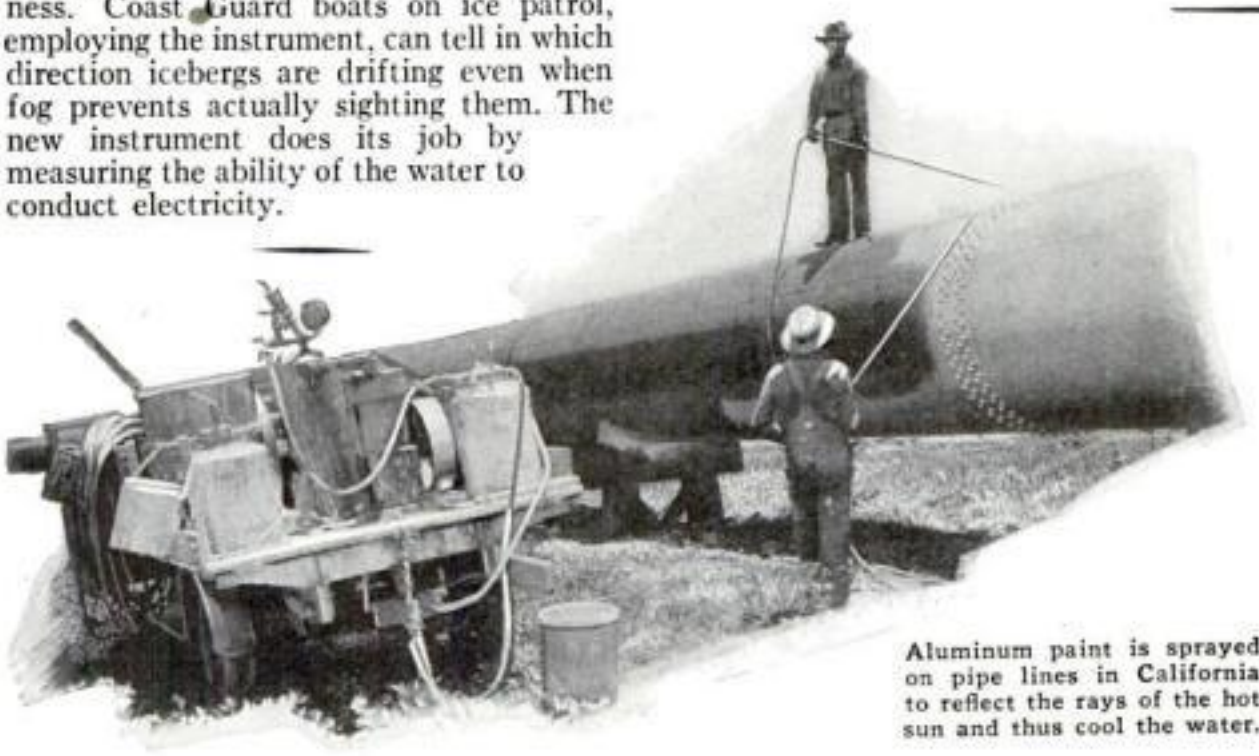
ANALYSIS OF BLOOD WINS NOBEL PRIZE

DOCTOR KARL LANDSTEINER, of the Rockefeller Institute of Medical Research, was awarded the 1930 Nobel Prize in medicine for his studies of human blood. It is upon his discoveries that much of the science of blood transfusions is based. Such operations can only be successful, he found, when blood of the patient and the blood-giver "match." Human beings are divided into four blood-groups, three of which were discovered by Dr. Landsteiner and one by an associate of his. Blood from a person in one group will not mix with that from another.



Dr. Karl Landsteiner in his laboratory examining specimens of human blood. For this work he was given the Nobel Prize.

When Dr. Landsteiner tried to mix blood from two different groups in his test tubes he found that red blood cells often bunched together as if they were glued. When this occurs in human veins, the patient dies. This discovery has also been used in attempts to prove the parentage of doubtful children.



Aluminum paint is sprayed on pipe lines in California to reflect the rays of the hot sun and thus cool the water.

ALUMINUM PAINT KEEPS WATER COOL

KEEPING water cool by covering the pipe with aluminum paint was the idea recently hit upon by engineers of the Oakland, Calif., water department.

Aluminum paint was used because it reflected the sun's rays instead of collecting them as ordinary paint would. It was applied by an air-spraying device mounted on a truck. This is said to be the first time that paint has been used on water pipe lines.

FLUE GAS IN OIL TANK CHECKS FIRE HAZARD

PUMPING flue gas into tanks is one of the latest methods of reducing the ever-present fire hazard in oil-tank steamers, according to a recent announcement of the Petroleum Institute of Chicago. Smoke from the ship's boilers is washed and cooled and the remaining gas is forced into the tanks to displace air. This system has been successfully applied to storage tanks and refineries ashore.

As oil cargoes are unloaded, air is drawn into tanks through ventilators, forming a highly explosive mixture as it mingles with the oil fumes. When tanks are filled a similar condition exists, as they are never loaded to capacity, space always being left for expansion of cargoes. Such conditions in themselves are not dangerous, but the smallest spark in contact with the vapor would cause an explosion. When a tank vessel is at sea, cargo swishing around in the tanks might generate enough frictional electricity to make such a spark. Filling the tanks with flue gas averts the fire hazard under such circumstances by confining the oil and preventing the possibility of a dangerous heat producing friction.

Oil tank trucks usually drag a length of chain along the roadway to carry off current formed by their contents swishing about, the chain acting as a ground short-circuiting the tank.

MACHINE MIXES PLASTER AND PUTS IT ON WALLS

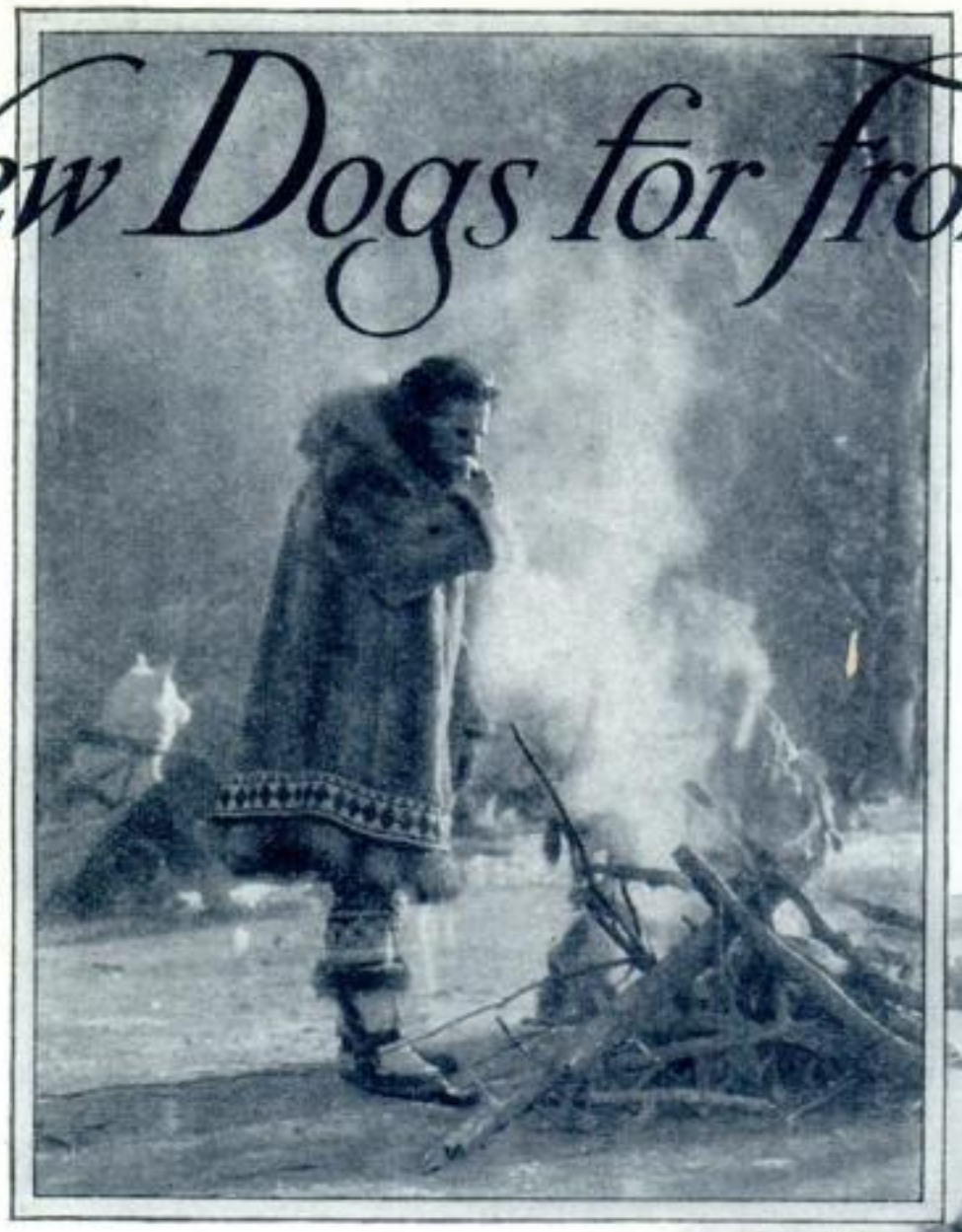
APPLYING interior or exterior coats of plaster on various building material is now done with an air-operated machine developed in California. The machine mixes and applies the plaster to the walls, but keeps the plastering materials dry until a few seconds before they are applied, thus avoiding, it is claimed, any tendency to "set" before the plaster is on the wall. The trowel is used only to spread the material after it has been applied. The machine, according to its inventor, will handle all grades of plastering from the first coat to the last.

Plaster of all grades is mixed and applied to the walls by this machine, recently developed.

New Dogs for Frozen North

While airplanes and motor cars invade Arctic waste, dog teams still reign supreme over large areas. This spurs efforts to breed for speed and for strength.

By
JAMES W. BOOTH



Leonhard Seppala, famous for his feat in winning, three times hand running, the $10,000 Alaskan dog derby, stops for a bit of lunch while his team of Siberian prize winners rest.

Mushing through the white wastes of the North with a team of eighteen dogs hitched to one sled. This is an unusually large team, but so well trained are these animals that large strings of them tend to business and cause little trouble.

SWIFT, stout-hearted husky teams from far away as northwestern Canada will meet in a test of speed and endurance at Quebec next month, when the Eastern International Dog Sled and Derby Race is run for the championship of the world.

Even if a blinding blizzard should change the country into a trackless white waste around Washington's Birthday, the furry four-footed trail blazers of the frozen North will streak across the snows to win the gold cup and money prizes for their mushing masters. For three days they will dash over the 120-mile course, in three heats of forty miles each.

This international event is the most important in a series of contests to be staged from the middle of January until the beginning of March over a far-flung territory stretching from Maine to northern California and from New York State to Manitoba.

The fact that races will be run at such widely separated places as Lake Placid, N. Y.; Poland Springs, Me.; Laconia, N. H.; Ottawa, Ontario; Le Pas, Manitoba; Ashton, Idaho; and Truckee, in the Lake Tahoe region of California, indicates a general revival of interest in one of winter's most thrilling sports—the dog derby.

Meet Nurmi and Jehn, two of the imported thoroughbred Siberians at the Seppala-Ricker kennels.

Once strictly Alaskan, it was adopted by Canada and now has stirred the imagination of dog lovers throughout the United States.

These spectacular, exciting races, however, are far more than mere sporting events. In their staging, science and sport are coöperating to perpetuate and improve existing breeds and to originate new ones.

WHILE the railroad and the airplane, constantly pushing further in toward the Arctic Circle, are minimizing the importance of the dog sled as a means of transportation, the husky's usefulness both in scientific and commercial endeavor is by no means at an end.

On his return from the Antarctic, Admiral Byrd declared that, without his dogs, he could not have accomplished his work of exploration. Airplane flights proved invaluable for survey purposes, he said, but it was the dogs that paved the way for all detailed observation. The late Nansen and Amundsen, greatest of Norwegian explorers, each expressed the opinion that the sled dog is indispensable for any prolonged observation in the Arctic and Antarctic regions.

So far as industry is concerned, power-generating machinery has found its way north of fifty-

To train sled dogs in a country where snow is scarce, they are hitched to a big car and made to drag it over fifteen miles of country road.

At right, Mrs. Elizabeth M. Ricker of Poland Springs, Maine, with five of the Siberian dogs she is raising at the Seppala-Ricker kennels for the races.

six degrees latitude, and horses and motors are being used for the bulk of transportation in the settled districts; but the dog still reigns supreme in thousands of square miles encircling the outposts of civilization, and the rough work falls to his lot.

The dog can haul a load where a horse is useless. As a matter of fact, the Quebec races are financed by a group of men who control vast lumber interests in the far Canadian Northwest, where timber still is hauled exclusively by dog teams.

THESE and other sponsors of the sport have injected a new spirit into dog racing. In the old days, the drivers' incentives were pride in their teams, the joy of competition, and the chance of pocketing a substantial prize. Today, the chief objective is to find a strain of dogs that combines the important qualifications of speed, endurance, and intelligence.

This change in viewpoint is clearly reflected in the way dog derbies now are conducted. While the thrill by no means has been taken out of the sport, the races have become comparatively conservative affairs. In the days of the All-Alaska Sweepstakes, the great dog racing classic that was abandoned in 1917, dogs and men often fought death and each other over a course of 408 miles.

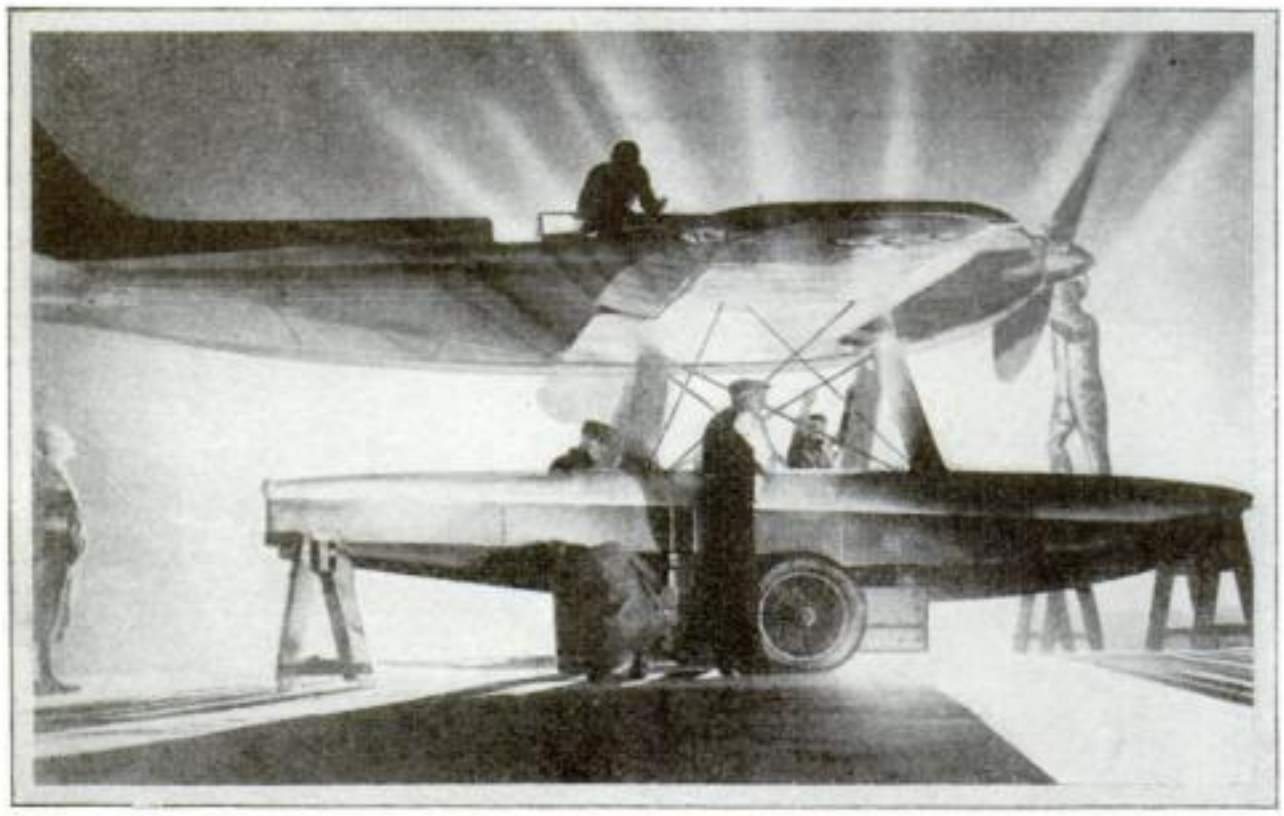
Nowadays, the races are run over shorter courses, ranging from twenty-five miles at Poland Springs, Me., and Lake Placid, N. Y., to 200 miles at Le Pas, Manitoba. Championship in the All-Alaska Sweepstakes carried with it a purse of $10,000. Today, a gold cup and $1,000 are awarded the winner at Quebec, and a like amount in other important derbies.

To encourage the breeding of a real northern dog, a "condition prize" of $500 is given at Quebec and Laconia, N. H., to the driver of the dogs that reach the finish tape in best condition. This prize is awarded only for those dogs which, in an inspection made previous to the races, prove to possess the necessary thick, warm coats, and well-furred feet with good, strong pads.

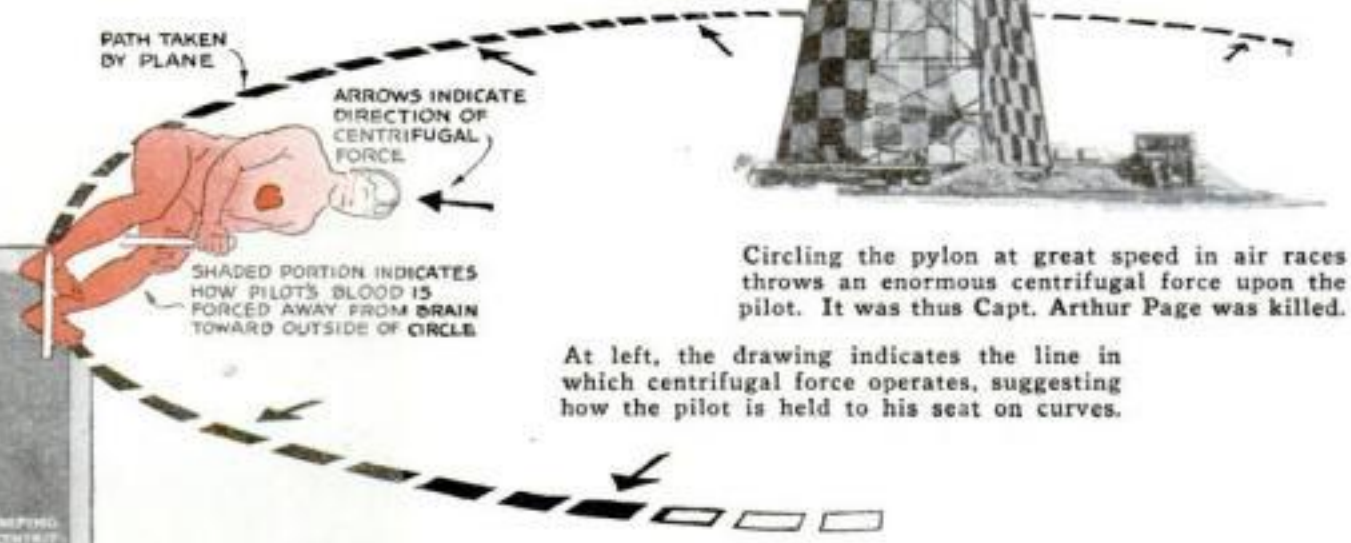
Attempts to breed a northern dog characterized by speed, endurance, and intelligence date from the time when the white man first began to penetrate the northern wastes. What probably happened was explained to (Continued on page 140)

Ice and frozen pieces of snow are hard on the feet of the dogs and at top one of the team is getting first aid treatment for a sore paw. Above, the gee pole is used like a wagon tongue to guide the sled.

Can Men Pilot Rocket Planes at 5,000 Miles an Hour?

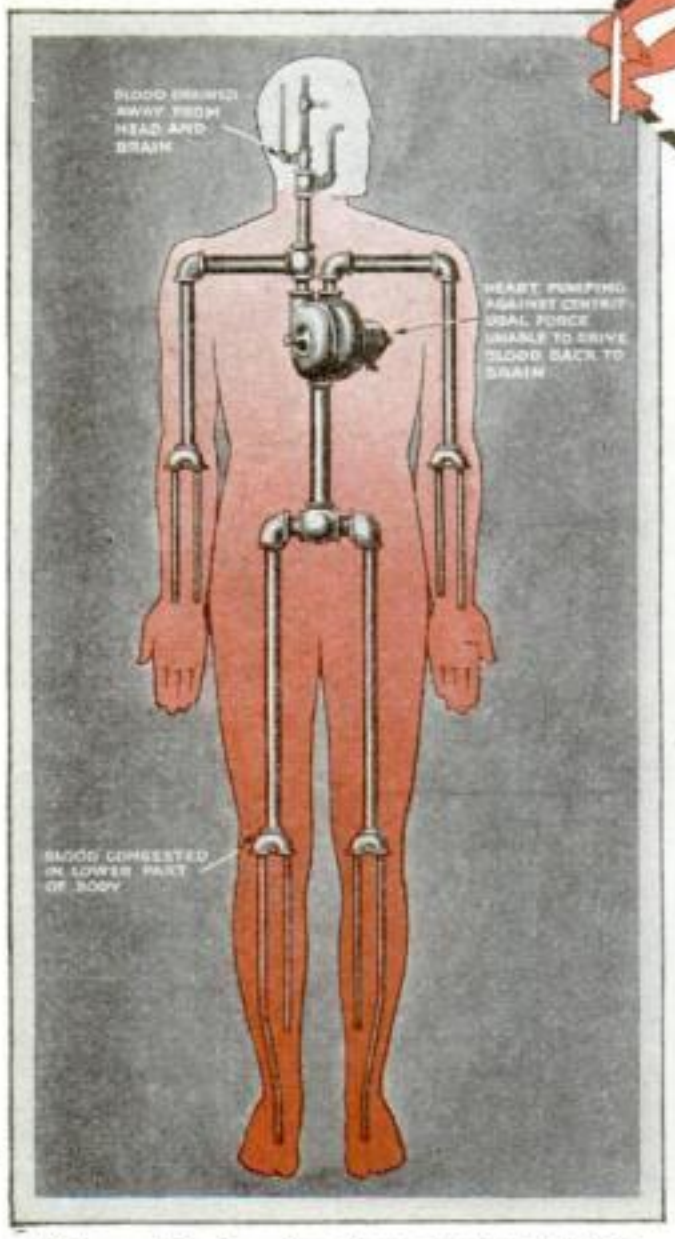


The fastest craft in the world. This Supermarine seaplane has been driven up to the amazing speed of over six miles a minute —368 miles an hour. Flight at twelve to eighteen miles a minute is confidently predicted by many experts for the near future.



Circling the pylon at great speed in air races throws an enormous centrifugal force upon the pilot. It was thus Capt. Arthur Page was killed.

At left, the drawing indicates the line in which centrifugal force operates, suggesting how the pilot is held to his seat on curves.



This graphic drawing shows clearly what happens when centrifugal force holds blood away from brain by overcoming the heart's action.

Flying in Straight Line Is No Strain, but Turns at High Speed Stop the Heart

By GEORGE LEE DOWD, JR.

FROM New York to San Francisco in thirty minutes; from San Francisco to Hongkong, China, in an hour and a half; around the world in five hours!

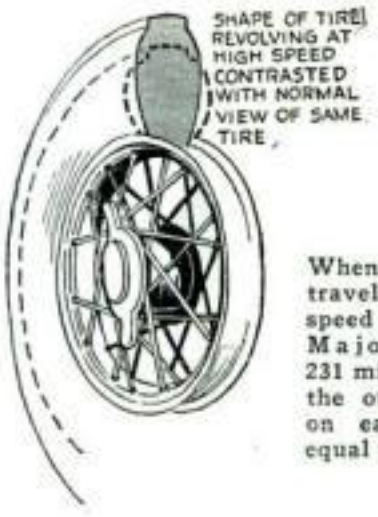
Such are the incredible airplane speeds predicted for a dozen years hence by Fritz von Opel, famous German experimenter and the first man in the world to ride a rocket plane. Man-made meteors, capable of 5,000-mile-an-hours speeds, will be common in 1942, he says.

At the present moment, there is under construction in a closely-guarded room of the Junkers factory in Germany an engine-driven craft designed to fly 700 miles an hour or faster (P.S.M., Jan. '31, p.53). Racing across the sky, seven miles up, it is expected to carry passengers in a streamlined, sealed cabin from Berlin to New York in approximately six hours.

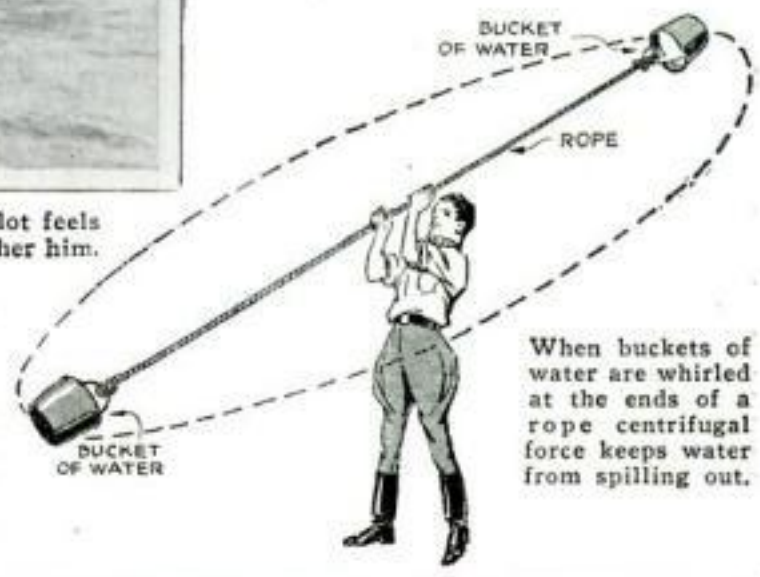
Aerial travel at breath-taking speeds is an actuality. Captain Frank M. Hawks has flown his Mystery monoplane from coast to coast at more than three miles a minute. In racing planes, four miles a minute is slow. The British pilot, Captain A. H. Orlebar, has rocketed by the Isle of Wight on his Supermarine seaplane at more than six miles a minute.

Louis Bleriot, the first man to fly across the English Channel, forecasts 700 miles an hour speeds within ten years, and F. H. R. Folland, designer of Orlebar's machine, sees no reason why racing ships cannot attain 1,000 miles an hour within

Another view of the fastest machine yet built by man. In its closed cockpit, the pilot feels no discomfort when moving six miles a minute in a straight line. Only the turns bother him.



When a car is traveling at the speed attained by Major Segrave, 231 miles an hour, the outward pull on each tire is equal to four tons.



When buckets of water are whirled at the ends of a rope centrifugal force keeps water from spilling out.

the next twenty years or perhaps sooner.

These figures are given for engine-driven planes. The success of huge rocket-propelled machines, such as are foreseen by Von Opel and others, would open up an entirely new realm of speed possibilities.

Even conservative aeronautical engineers admit that the era of speed, which has lifted the record from about 170 miles an hour in 1920 to more than 360 miles an hour in 1930, has just begun. Where will it end? What will determine the limit—the weakness of machines or men?

Not long ago, a well-known engineer wrote an article in which he declared that a plane going more than 500 miles an hour would become heated by the friction of the atmosphere so that it might actually melt in the air!

The answer given to this objection is that the high-speed planes of the future are planned to race along the speedways of the stratosphere—the thin air many miles above the earth. They would climb at relatively low speeds through the denser atmosphere near the earth's surface to levels where the friction would be slight.

It is interesting to note that calculations indicate that at a height of 740 miles, a speed of a little more than six miles a second would allow a plane to break away from gravity and escape into space.

But the fact that future speed planes will use the upper air levels presents other problems to the designers. Ordinary machines lose speed as they go higher because of the inefficiency of their propellers, which cannot grip the thin air. The Junkers plane, now under construction, is to have a variable pitch propeller to overcome this difficulty. It can be adjusted during flight to take a greater "bite" as the air becomes thinner. Rocket planes would not have this difficulty and would be just as efficient high in the air as near the earth's surface.

Nor would they be affected, as engined craft are, by the lack of oxygen and the extreme cold of the upper reaches. High-flying speed planes, powered by motors, will have to be equipped with superchargers to feed oxygen to the engine and heating equipment to keep it warm. At such levels, the air is too thin and too cold to support life and the pilot and passengers must ride in sealed cabins in which the pressure, temperature, and oxygen-content of the air is automatically maintained.

All of these problems, designers believe, can be solved. Tremendous speeds are mechanically possible, they declare, especially if the rocket form of propulsion proves to be practicable. As far as machines go, there appears to be no speed limit yet in sight.

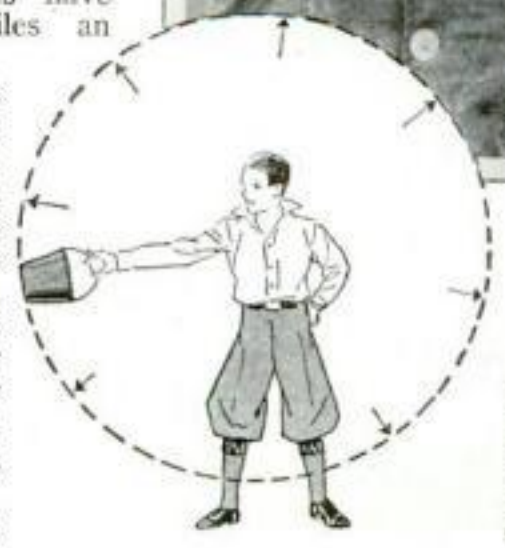
But what of the pilot and passengers? Will the human body be able to stand the terrific pace of future planes? For uncounted centuries, men have been crawling slowly over the face of the earth. The fastest sprinter on a cinder track never reaches twenty-five miles an hour for the hundred-yard dash. The greatest speed attained by muscle-power is made by the gazelle, a fleet-footed animal which can run sixty miles an hour.

With the coming of the machine age, the speed records increased by leaps and bounds. The *Bremen*, speediest ocean liner, crosses the sea at a rate of approximately thirty-two miles an hour, and Gar Wood's racing hydroplane has skimmed the surface of a lake at nearly 100 miles an hour. Steam locomotives have run at 120 miles an hour.

The fastest thing on rails is the Opel rocket car, which attained a speed of 156 miles an hour in tests near Hanover, Germany. The highest speed ever attained over ground is 231 miles an hour,

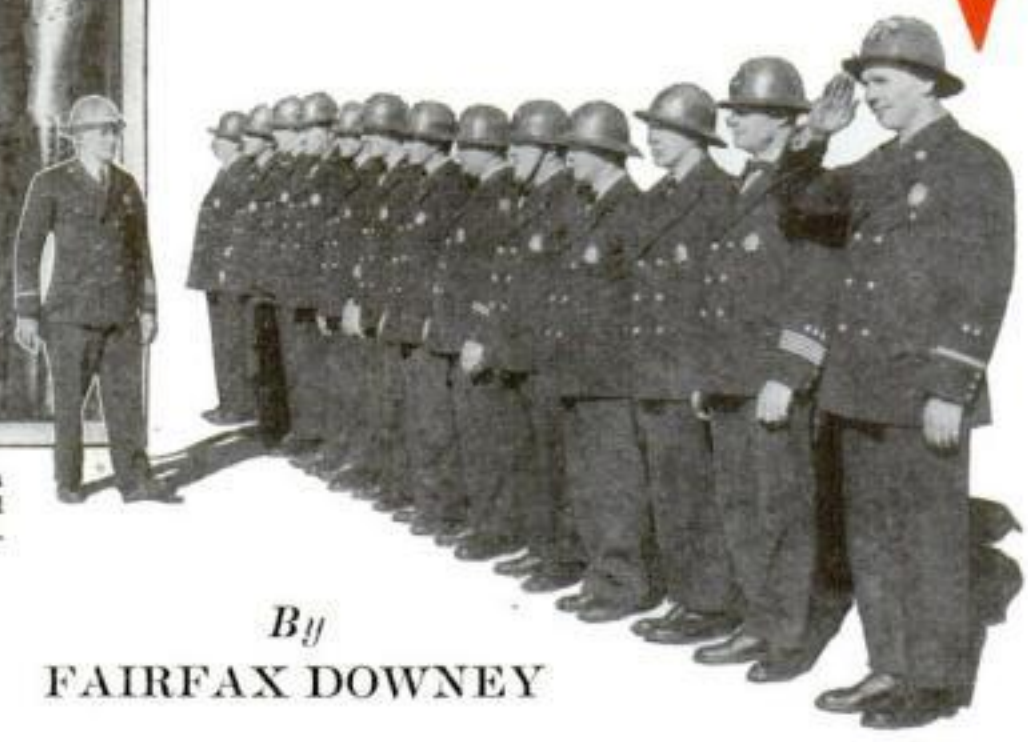
(Continued on page 134)

Captain A. H. Orlebar, England's flying ace, after moving faster than any other man in the world ever moved, stepped out of his seaplane unharmed by his experience in flying at 368 miles an hour.



At left, an illustration of the tendency of moving objects to fly away from the point of control. This tendency increases with speed, and is due to the centrifugal force.

Ancient Armor Copied *for* Modern Warriors



Polishing armor. Right, helmets of Pasadena firemen are copied from those of Middle Ages.

By
FAIRFAX DOWNEY

AN ARMORED automobile draws up at the door of a bank and guards who wear steel-plate vests carry in the money bags. Police in armored motorcycles answer a riot call. Machine guns splatter lead against the bullet-proof walls and glass windows of a gangster's limousine.

Soldiers maneuver in helmets, following the great, mobile shields we call tanks. Navy gunners hurl their shells at the armored turrets of retired battleships. Arsenals experiment with the important problem of the armament of airplanes.

Ancestors of all this present-day armor, the iron shells in which the knight of old and his charger were encased, are exhibited in our museums. They are relics of the past, but neither the lead-piping times of peace nor the blasts of modern warfare permit them to be classed as back numbers. The end of armor has been prophesied since the advent of powder and on through the days of high-velocity firearms. Yet experts went straight to the helmet collections for hints on designing the "tin hats" of the World War; and the plate and chain mail of past centuries served as models for sniper's breastplates.

The collection of armor in the Metropolitan Museum of Art, New York City, is regarded as of technical, historical, and artistic interest. It comprised 4,700 pieces before the recent addition of the late Bashford Dean's collection, one of the three most important private armories in the world. The Museum is a counterpart of the arsenals maintained by kings and princes in the age of iron men. Like them it has its armorers and its armorer's workshop for restorations, repairs, and cleaning.

If you inquired at the Museum for its armorer's shop, you would be shown that fascinating exhibit that is a duplication of the workroom of an armorer of the Middle Ages. The Museum's own shop, part of its operating department, is not open to the public. In it are hooded forges, bellows, anvils, vises, patterns, shears—all the implements of the craft.

DURING the World War, the Museum put at the disposal of the Government its armorer's shop and the services of its armorers headed by the late Daniel Tachaux. He designed several models of helmets which were copied in proof metal and sent to the helmet board in France.

Tachaux, who brought from his native France many tools of his craft and secrets of the armorer's guild handed down through generations, once wrought a helmet after the ancient fashion in the Museum shop. It was produced as a restoration of the missing headpiece of a very old and handsome suit of armor.

The armorer hammered the helmet out of a single sheet of steel, using special hammers to shape the heated metal and later employing annealing to make it workable. At all times it was necessary for him to keep in mind not only the next but

Helmets worn by American soldiers during the World War were direct descendants of those that were used by medieval knights.

In this hall of armor at Metropolitan Museum, New York, are seen steel shields for body and head, as well as for steed, worn when knighthood was in flower.

In the long ago, rider and horse were both protected from lance and dart by skillfully jointed armor.

The figure of this mounted and armored knight is studied by experts interested in designing armor for present-day use.

Around the dummy figure breastplate, steel leggings, and halbert are mounted before museum piece is ready.

also the advanced stages of the process.

Now a press can stamp out in a day more helmets than an old-time armorer could forge during his life. But the craft of the old masters never has been excelled. They could achieve ornamentations in iron that the goldsmiths could not surpass. The embossed points and ridges of their mail were not thinned but thickened at the top. On the contrary the crest was the weak point of the machine-made helmets worn by the French in the World War.

High technical skill is required not only in the making of armor but in its repair. Even the task of cleaning it demands knowledge and care.

The Museum fights rust on armor as zealously as did its original owners in the days when knighthood was in flower. Four armorers in the shop do the work that was once done by squires and arsenal servitors. Present methods, barring a few improvements, parallel the ancient usages.

Extremely rusty pieces received at the Museum are heated with a torch or soaked in kerosene for from two days to two months, after which the loosened rust yields to a stiff bristle brush. Surfaces are rubbed with various grades of emery cloth moistened with oil. After the kerosene has been removed, the surfaces are cleansed with alcohol and the metal warmed for an even spread of a coating of oil.

Caustic potash, powdered rottenstone, and even a grindstone may be used for rust removal. Yet every piece to be cleaned requires a special diagnosis. The etching of plate armor or the fine pattern on a Damascus or Japanese blade can easily be ruined by indiscriminate cleaning.

Armorers used to clean chain mail by putting it in a barrel with sand and vinegar and shaking it. The mail thus received an excellent burnish and at the same time the barrel was well scoured and made ideal for holding ale. Link armor now is soaked in kerosene and placed with sawdust in a tumbling machine.

When harnesses are ready for exhibition, they are given a thin coating of viscous oil. Paint, of course, also would be a rust preventive, but the armor must be restored to its former state and little painted mail is extant. However, the Red Knight, the Green Knight, and the other figures of the romances who wore it have perpetuation of their precedent in the painted armor of the World War. And another debt is owed to the painted armor of the past, for the bare spots made on it by the blows of weapons oxidized in the air and the marks left suggested the process of etching by acid.

The surviving specimens of the armorer's craft are worthy of especial care and preservation even from the utilitarian standpoint. History has emphatically repeated itself on the subject of armor. Even in this country, so little associated (Continued on page 149)

New Silencers and Mufflers for Your Windows Bar Noise but Let in Fresh Air

Hiram Maxim adapts gun silencer to stop street noise.

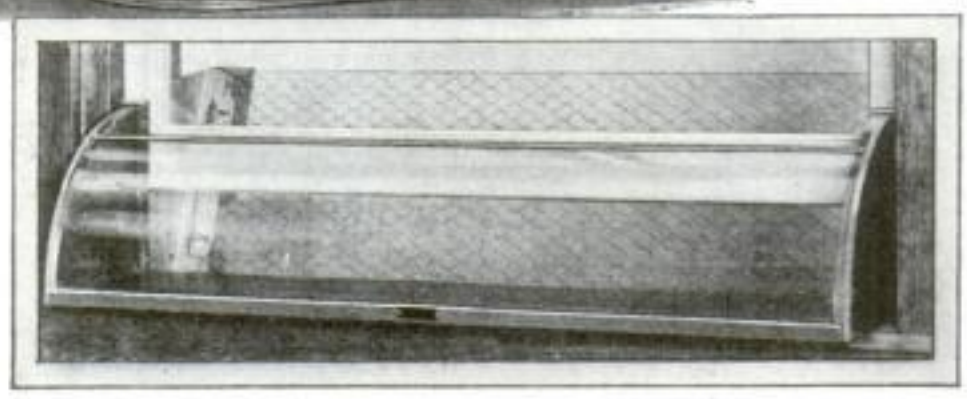
Now "silencers" and "mufflers" can be applied to the windows of your home or office as easily as to a gun or an auto exhaust. They are the latest advance in the nationwide war against noise.

Recently the "Maxim silencer" for windows, a product of the noted inventor who perfected silencers for firearms and for industrial machinery, was announced at Hartford, Conn. At the same time, installations were being made in San Francisco of another type of "window muffler" designed by the late Prof. J. F. Newsom, at Stanford University, California.

Prof. Newsom rigged up a tub of mercury, in which he laid a model of a window frame, in order to study the movement of sound waves around it. Ripples in the mercury simulated sound waves.

Further tests of a model "muffler" were made in a unique fashion. A man with a .22-caliber revolver walked away from the open window of the laboratory, firing the revolver at measured distances. An observer, within, measured the intensity of the noise with the aid of a specially-designed microphone. Out of these experiments, checked both with and without the muffler, came the "silencer" which consists of a slanting shield outside the window and a curved hood inside.

To his window silencer, Maxim applied the principle used so effectively in the muffler for guns—a series of baffles to trap sound, but not to obstruct the flow of gas. These he arranged compactly in a flat box, only five inches high, that fits beneath a window shut tightly upon it. To insure a good supply of fresh air he built into his device a reversible fan which blows air into a room or sucks it out.



This window silencer consisting of slanting shield and curved hood, was invented by J. F. Newsom, Stanford.

Diagram of the Newsom muffler showing how tests were made with gun and microphone to gage noise.

80,000 PULLMAN TICKETS USED EACH DAY

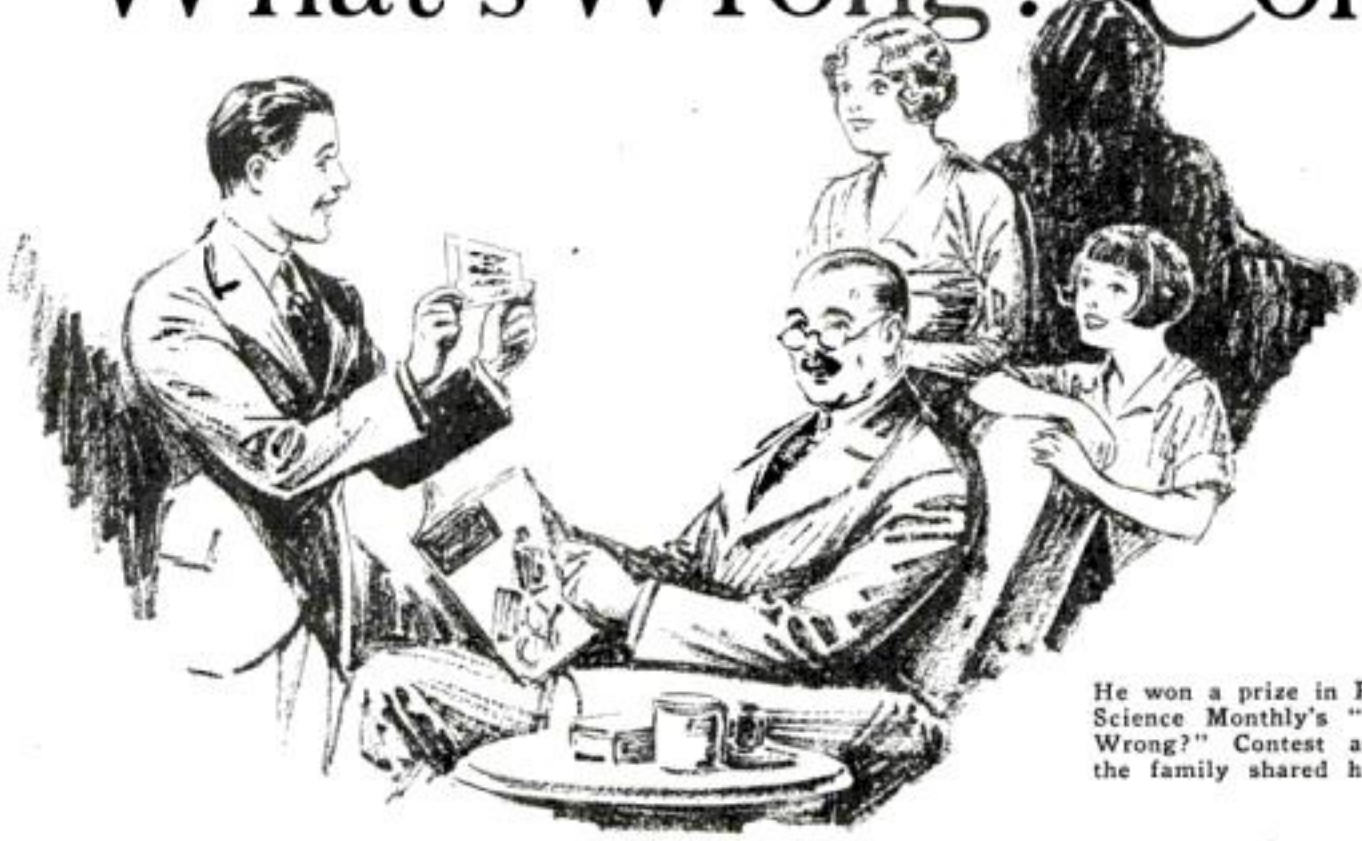
GETTING an upper or lower berth at a Pullman ticket window may seem a simple operation, but it represents a staggering amount of effort on the part of the sleeping car company. The picture shows one day's supply of tickets, 80,000, boxed and ready for shipment to ticket sellers throughout the country, this number being required to meet the demand.

Clerical work in providing you with a comfortable bed as you speed over the rails does not end here. Each ticket is in three sections, and two of these are returned to the Pullman offices by different means. The agent keeps one part and sends it back with his periodic report. After you have boarded the train, the conductor collects one piece of your ticket and sends it in with his report.

It has been estimated that one year's sale of Pullman tickets, amounting in all to about 29,000,000, if placed end to end would reach from Chicago to Boston, with the eastern end sticking out a few miles into the sea.

Want a Pullman ticket? Here are 80,000 of them stacked up in boxes ready to be sent out to meet the demands of one day's business. About 29,000,000 of them are used each year.

Winners in the November "What's Wrong?" Contest



He won a prize in Popular Science Monthly's "What's Wrong?" Contest and all the family shared his joy.

FIRST PRIZE 500 DOLLARS
Charles T. Sharpe, Los Angeles, Calif.

SECOND PRIZE 100 DOLLARS
W. V. Chambers, Swarthmore, Pa.

THIRD PRIZE 50 DOLLARS: Frederick E. Beaumont, New Bedford, Mass.

TEN PRIZES OF TEN DOLLARS EACH

Elmer B. Benson, Rock Island, Ill.
Leonidas W. Ellis, Cherrydale, Va.
Albert R. Getchell, Boston, Mass.
John Hackett, Centralia, Wash.
Andrew J. Kelley, Utica, N. Y.
E. A. Matthews, Gibsonburg, Ohio.
Marion Trevarthen, Michigan Center, Mich.
Harold W. Readen, Anderson, Ind.
Derrick P. Rusden, Providence, R. I.
Russell G. Young, Washington, D. C.

FIFTY PRIZES OF FIVE DOLLARS EACH

Ernest Arnold, El Paso, Tex.
B. H. Bell, Rapid City, S. D.
Joseph A. Bieke, Detroit, Mich.
James Bolton, Regina, Sask.
Le Roy W. Boughton, Berwyn, Md.
Joseph Brockman, Cincinnati, Ohio.
Andrew S. Burtnett, Hannibal, Mo.
G. W. Buzby, U. S. S. *Vestal.*
A. R. Chesney, Mannington, W. Va.
Elmer H. Cousins, Northeast Harbor, Me.
Robert C. Forbes, Somers, Conn.
Avis H. Fox, Brockton, Mass.
W. M. Furlow, Albany, Ga.
Mrs. Guy A. Garrett, Clarksburg, W. Va.
Charles A. Garverich, Harrisburg, Pa.
Wm. E. Geer, Pueblo, Colo.
Sister Agnes Gonzaga, Tipton, Kans.
Bessie M. Hahn, Wilkinsburg, Pa.
Edgar W. Hall, Catskill, N. Y.
Herbert C. Haller, Lawrence, Mass.
A. E. Heatherington, Orlando, Fla.
Walter Heiss, Appleton, Wis.
William Herrmann, Jr., Hamden, Conn.
M. H. Holroyd, Steubenville, Ohio.
W. F. Jensen, Tippecanoe City, Ohio.
John M. Keating, Beacon, N. Y.
J. E. Lapp, Orono, Me.
G. H. Leaverton, Baltimore, Md.
Ben Lewis, Venice, Calif.
Clifford K. Lodder, Syracuse, N. Y.
William G. Lownds, Brooklyn, N. Y.
Chas. A. Merritt, Racine, Wis.
Bertha W. Milbee, Ravenna, Ohio.
A. W. Mitchell, Portland, Me.
Oscar L. Morris, Salisbury, Md.
Franklin F. Murdoch, Washington, D. C.
Clara Pfister, Kenton, Ohio.
F. W. Rahrer, Anniston, Ala.
J. O. Ritter, Clarksburg, W. Va.
Joseph F. Sisler, Yonkers, N. Y.
Clyde W. Slocum, Cobleskill, N. Y.
W. O. Spoon, Portland, Ore.
R. V. Stevenson, Malvern, Ark.
D. W. Sutherland, Sioux Falls, S. D.
P. C. Swan, Arco, Ga.
R. H. Swartzwelder, Hartford, Conn.
S. Wallwork, Athol, Mass.
Mrs. E. R. Webster, Denver, Colo.
Andrew H. Young, Boston, Mass.
A. D. Zimmerman, Blue Mound, Ill.

STILL TIME TO WIN A BIG CASH PRIZE!

THE FINAL "What's Wrong?" Contest, which appeared in POPULAR SCIENCE MONTHLY last month, does not close till January 31. Therefore you still have time to get into this big contest in which you may win the $500 first prize or one of the other sixty-two cash prizes.

The four "What's Wrong?" Contest pictures appeared on pages twenty-eight and twenty-nine of the January number.

To enter the contest all you have to do is to figure out what George is doing wrong, find the four photographic errors in each picture, write or typewrite your answer and mail to POPULAR SCIENCE MONTHLY by January 31.

And if you get busy right away, you have just as good a chance to win as anyone! You don't even have to dig up your copy of POPULAR SCIENCE MONTHLY for January. Look over this copy of the magazine in any public library or office of POPULAR SCIENCE MONTHLY. Rules are on page thirty-one of that issue.

POCKET PROJECTOR SHOWS 250 PICTURES

This pocket projector, weighing less than two pounds, is used to demonstrate salesman's goods.

A SMALL picture projecting machine that can be carried in a salesman's coat pocket will help him demonstrate his product and its uses to prospective customers. About the size of a pocket camera, it will operate on ordinary house circuits. It can be plugged into any light socket, after which it is only necessary to turn a knob to flash each picture, in succession, on any convenient blank wall.

The machine weighs but a pound and three quarters and uses standard film. It has a capacity of 250 different pictures. Illumination from a fifty-watt lamp with a coiled filament concentrates the light at the focus of the projection lenses.

TELESCOPE IS USED TO READ RADIO METERS

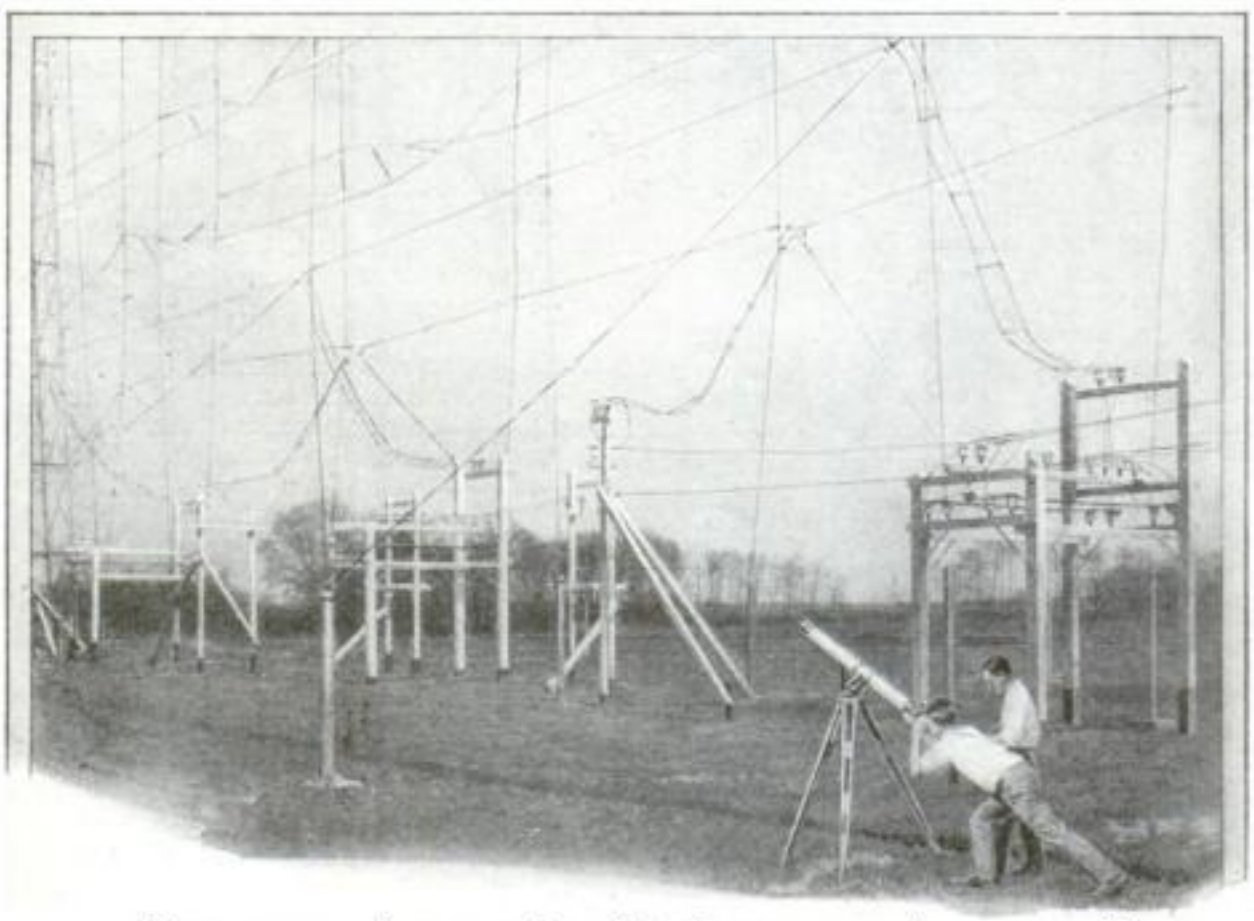
RADIO experts took on the appearance of star-gazers at Whippany, N. J., when the antenna of a large experimental radio station was decked with electric meters recently. Two young engineers of the Bell Telephone Laboratories, copying a scheme worked out by radio amateurs, made the rounds, measuring antenna currents, with a telescope.

One of them sighted through the eyepiece and called off the figures. The other jotted them down in his notebook. Thus the radio station solved a knotty problem, for the meters could not be lowered to earth to be read, and there was no way to get up to them.

ELECTRIC WATER POWER PLANT CROWDED STEAM

A FEW months after Thomas A. Edison opened his first electric generating station on Pearl Street, New York City, in 1882, the first electric water power plant was put in operation at Appleton, Wis. It was a crude affair, handling but 250 lamps and using the same type of dynamos that were installed in the first Edison plant.

They were driven by bevel gears and belting from the water wheel, which had a vertical shaft like the vertical-spindle water turbines that drive generators in present-day hydroelectric plants.



Meters strung on the antenna of a radio station to measure the current could not be read until two engineers used a telescope to make the figures visible.

SAILORS IN U. S. NAVY TO SEE SOUND PICTURES

TALKING picture apparatus will be installed in all United States warships, according to a recent announcement by the Navy Department. A contract for 200 talking moving picture machines, each of which will be installed in a different vessel, has been awarded. Arrangements were also made with producers to supply the talking films.

SCORE CARD ON PUTTER NEW GOLF NOVELTY

WHEN a player has finished playing a hole with this golf club, he need only lift it to record his score. The back of the head of the putter holds a removable score card, on which the number of strokes is marked with a pencil. When not in use, the pencil is carried in a clip on the shaft of the club.

A golfer has no excuse for failing to keep his score if he has a putter with card on its head.

THRILLING STORIES STOP BEAT OF CHILD'S HEART

THAT some fairy stories really do make a child's heart stand still momentarily while reading them has been proved by tests made at Harvard University, Cambridge, Mass. A special amplifier, sensitive to electric impulses emanating from the heart but insensitive to other muscle currents, has been developed.

The children tested wore two small metal buttons strapped to their chests and connected to the amplifier and recorder. Through this apparatus each successive heartbeat was marked on a record tape, together with time signals which enabled the rapidity of the beats to be noted.

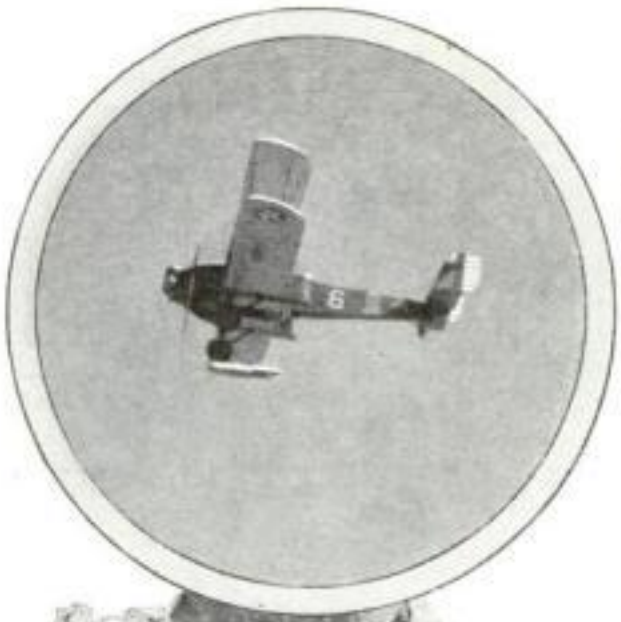
The children's hearts distinctly sped up or slowed down during emotional passages from fairy stories that were read to them. Return to the normal heartbeat was more delayed, it was noticed, when the story was one with which the child was familiar. This was taken to indicate that familiar songs or stories have a stronger and more lasting emotional appeal than new ones.

Raiding Planes in Mimic War Defeated by "Ears"

CAMOUFLAGED "ears" defeated a raiding air fleet not long ago, when a squadron of "Red" planes swooped toward Los Angeles in a mimic air war staged by the Army. Listeners swept the air with huge hornlike devices and caught the magnified sound of the distant airplanes' motors. A telephone call to a nearby air field followed, and a powerful defending fleet of "Blue" aircraft roared into the air to repel the invaders.

The mock battle gave Army men a chance to test under war conditions their latest equipment, including the sound detectors and huge 2,000-pound "demolition" bombs. The detectors are mounted for mobility on a four-wheeled chassis, and at the first warning of a coming air attack they can be rushed to the scene to listen for the invaders. Two observers man the apparatus, one to manipulate controls that turn it in any direction and the other to listen through hose like speaking tubes. Tree branches hung over the horns disguise the listening device from the air.

Air bombs are carried beneath the fuselage of the plane, between the wheels of the landing gear. They are released by a trigger from the pilot's cockpit.



The remarkable photograph at left shows an Army plane, one of the fleet used in the war game attack on Los Angeles, just as it has released a 2,000-pound demolition bomb which is carried beneath fuselage and tripped from cockpit.

This camouflaged "mechanical ear" is the Army's latest device to detect the sound of approaching enemy planes. Tried out on the Pacific Coast it gave satisfactory results. At left, while one observer aims the horn at various parts of the sky, another listens through tubes for warning hum.

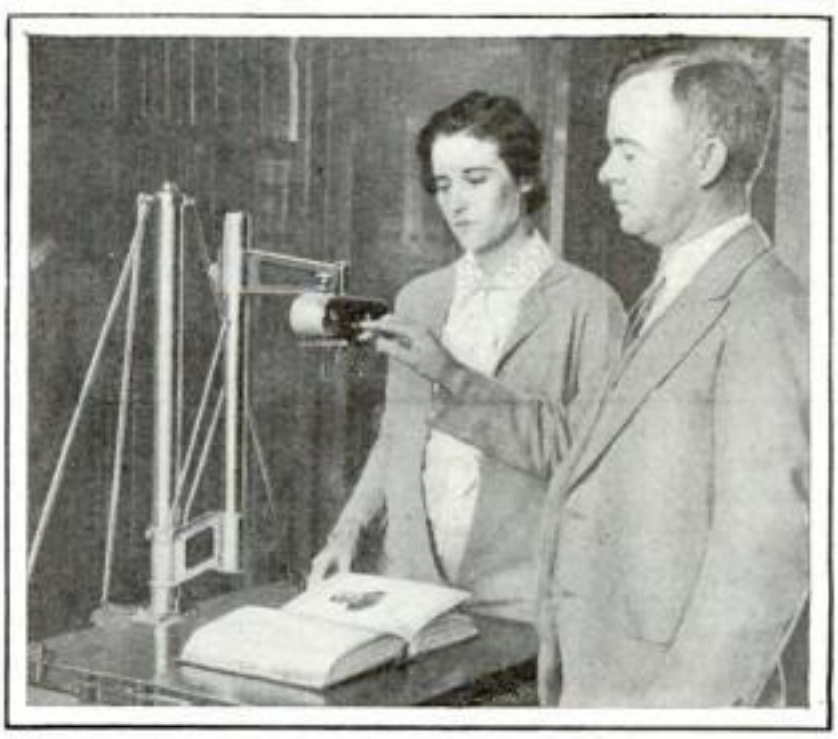
1,000 FILM BOOKS ON A SHELF

STORING a thousand books upon a five-foot shelf is the apparent miracle made possible by a camera recently placed in service at the Library of Congress, Washington, D. C. It photographs a book page by page upon a narrow strip of film with microscopic sharpness. The film requires small space for storage. When the celluloid copy of the book is to be examined, the film is placed in a special projector and thrown on a screen enlarged to normal size.

The camera is a European invention. Dr. Thomas P. Martin, of the library staff, became interested in its possibilities while engaged in securing copies of documents in foreign libraries and official archives. He developed the projector that he uses with it.

Important practical applications are seen for the filming system. Newspapers, the most perishable of any form of public records, may be preserved for future generations in film libraries. An ordinary-sized newspaper is reduced by the process to a three-foot roll of film that can be slipped in a vest pocket.

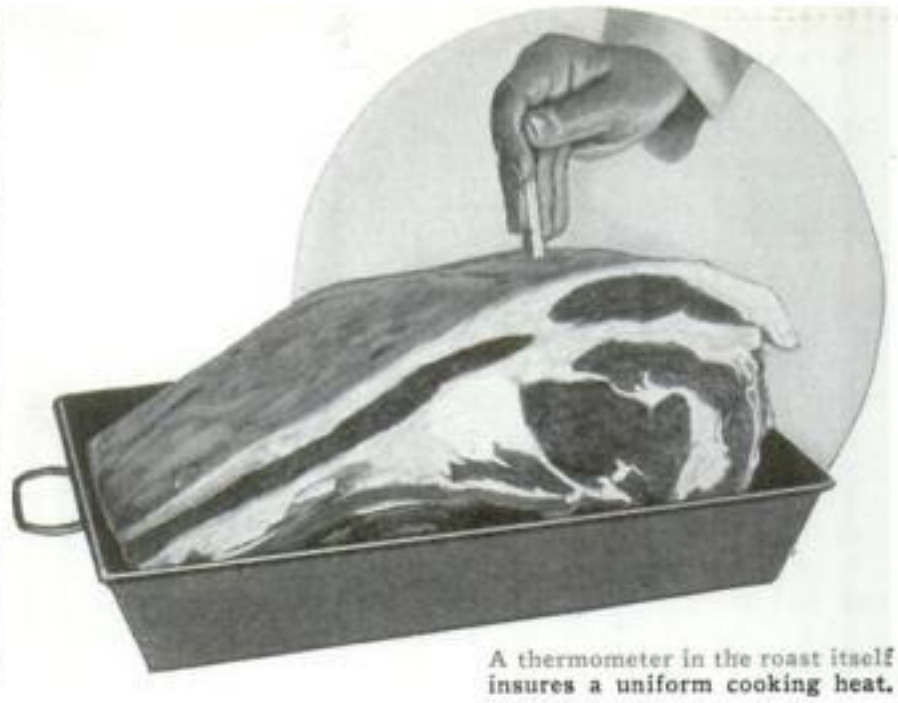
In addition, the new process makes it possible for a newspaper publisher to send unlimited copies of the paper to distant points by airplane, at no greater expense than the dispatch of ordinary air mail letters. Dwellers in city apartments may also use the device. In a limited space, booklovers will now be able to have as large a library of volumes at their disposal as they desire.



Dr. Thomas P. Martin, of the Library of Congress, demonstrates a European camera to film books to save shelf room.

Government Tests *Roasts* to Find Best *Meat* Cattle

By H. C. DAVIS



A thermometer in the roast itself insures a uniform cooking heat.

Getting roasts ready for the oven in the Government's experimental kitchen, Washington, D. C.

PEDIGREED roasts, scientifically cooked in a special Government kitchen in Washington, D. C., play an important part in the latest attempt to improve the livestock of America. With each roast that comes to the ovens of this meat-testing laboratory, there is a complete history of the breeding, age, sex, and feeding of the animal that produced it.

Twenty-five state experiment stations and other meat and livestock agencies are coöperating with the U. S. Department of Agriculture in this study of the factors which govern the palatability of meat.

Under the direction of Lucy M. Alexander, in charge of the experimental kitchen, more than 2,000 legs of lamb, nearly 1,000 rib roasts of beef, and about 400 cuts of pork have been cooked. In order to be sure that differences found in the cooked meats are due to the animals and not to the cooking, all roasts are prepared in the same way.

Careful records of oven temperatures and cooking periods are kept. This insures that the meat sent in from the experimental farms year after year from animals fed under identical conditions will be cooked in exactly the same manner.

Besides the oven thermometers which indicate the heat within each of the eight roasting compartments, meat thermometers are thrust into the center of the roasts to record internal temperatures and show when the meat is done. These instruments are marked "rare," "medium," "well done."

THE average temperature for rare roasts is 140 degrees Fahrenheit, for medium, 160 degrees, and for well done, 180 degrees. Such thermometers, taking the guesswork out of roasting meats, have recently been put upon the market for use in the home kitchen.

Besides keeping a record of the oven temperatures and time of cooking, the shrinkage of the meat is determined by weighing the roast before it is placed in the cooking oven and after it is taken out.

Here the final decision is made. These expert tasters sample a bit from each of the eight roasts and make record of its qualities.

At three o'clock in the afternoon, a jury of five expert "meat-tasters," selected from various bureaus of the Department of Agriculture, assemble to sample the roasts and decide upon their merits.

One at a time the roasts are sampled. Five slices are cut from each and the judges take a bite or two from the same part of their slices so they will all be examining the meat under similar conditions. They record their opinions on printed grading charts, giving their estimate of the intensity and desirability of the aroma, the flavor of the fat, the flavor of the lean, the texture, the tenderness and the juiciness of each piece of meat.

There are seven gradings for each item. For instance, a judge may encircle any of the following after "Quality of Juice": Very juicy, Juicy, Moderately Juicy, Slightly dry, Dry, Very Dry, Extremely dry. At the bottom of the chart, he checks the color of the lean, which ranges from light red to dark brown, and the color of the fat, which begins with white and ends with amber.

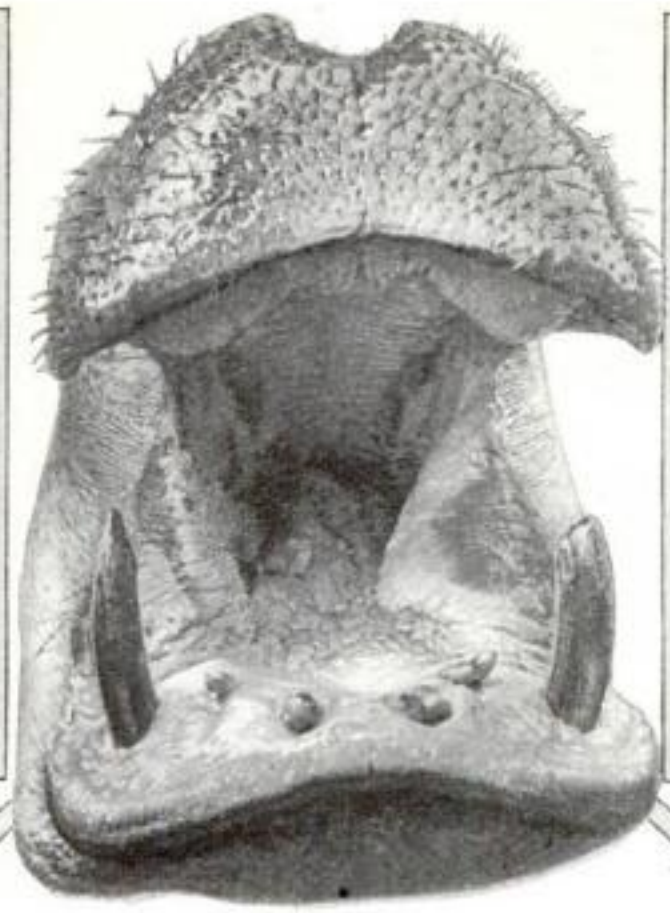
AN ADDITIONAL check upon the tenderness of the meat is obtained by the use of a mechanical tester, devised not long ago by the U. S. Bureau of Standards (P.S.M., Aug. '30, p. 48). It records the force necessary to cut through a given piece of meat when it is raw and again when it is cooked.

The work of the experimental kitchen, which is being continued over a number of years, is the first attempt to trace the effect of an animal's history upon the meat it produces by keeping records that start with its birth and end with the meat fully prepared for the table.

By use of the kitchen and expert judges, it is believed accurate information about the effect of various feeds upon the palatability of meat will be obtained to aid in raising superior meat-producing animals.

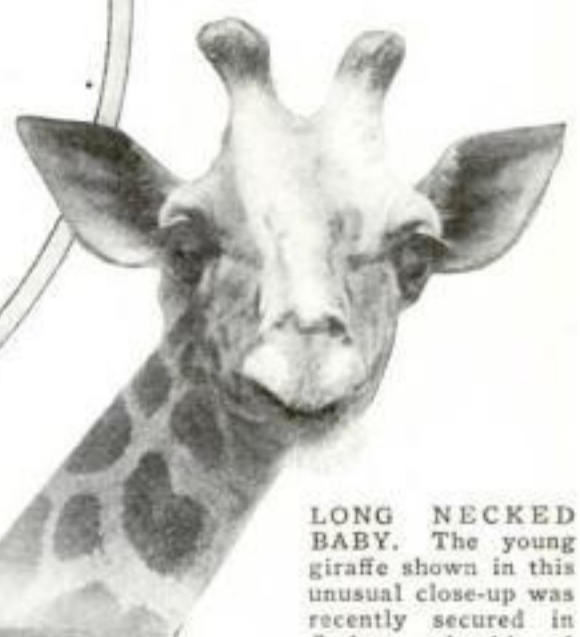
Weird Beasts Pose Before Camera

NOT AS BAD AS HE LOOKS. This baboon, with distended jaws, is enough to scare anyone, but it really is not ferocious, and in Abyssinia it was once held sacred. In center, the hippopotamus, roused from a nap, is trying to yawn itself wide awake. Picture suggests size of animal's mouth.

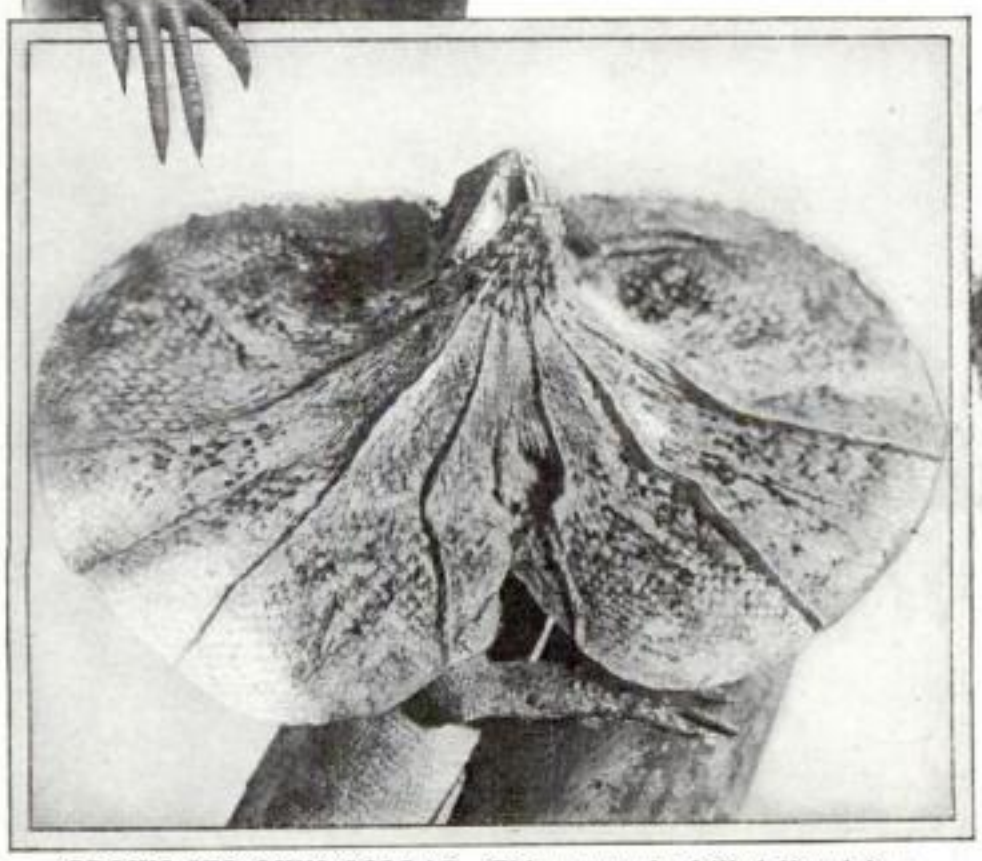


A COILER OF THE DEEP. Sea serpents are legendary, but many insist they have been seen. The sea snake shown above might pass for a fabulous monster of the ocean, as it was nearly ten feet long and full of fight when captured, after a stirring combat, off the coast of New South Wales.

UGLY IN LOOKS ONLY. The iguana, below, has not a pleasing expression, but as it eats only plants it is not dangerous, except when it strikes with its tail. It is found in Central and South America.



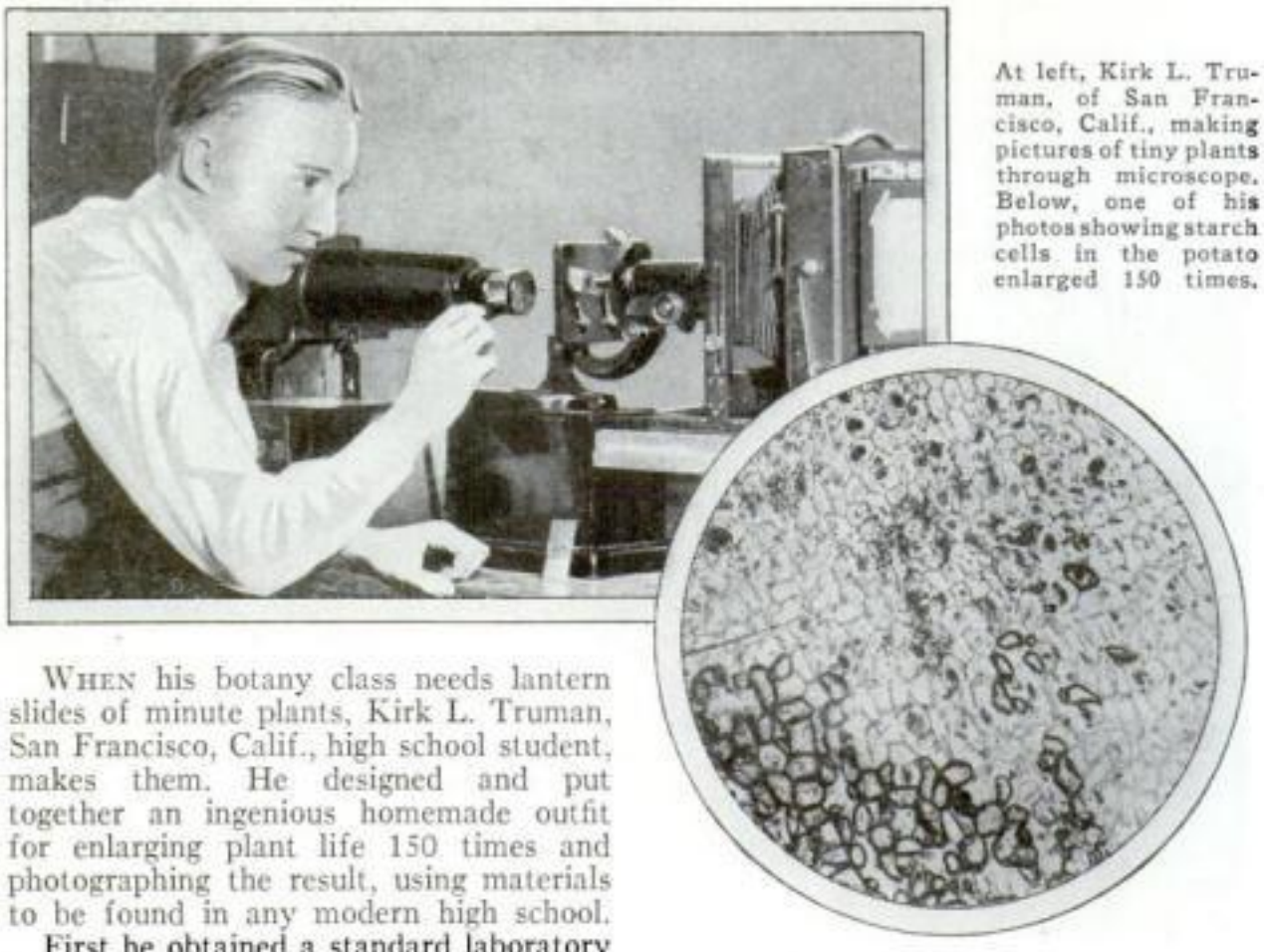
LONG NECKED BABY. The young giraffe shown in this unusual close-up was recently secured in Sudan and shipped to a zoo in London.



GROWS ITS OWN COLLAR. This strangely frilled lizard is a native of Australia, where the animals have developed along their own lines. The specimen shown here is in the Sydney Museum.

SNAPPED IN A MOMENT OF SURPRISE. When the Sir Douglas Mawson expedition invaded the Farthest South, last year, one of the strange animals encountered was the sea elephant. These beasts, sticking their noses above an ice floe, would stare in astonishment at the queer two-legged strangers.

ENLARGES TINY PLANTS IN PICTURES



At left, Kirk L. Truman, of San Francisco, Calif., making pictures of tiny plants through microscope. Below, one of his photos showing starch cells in the potato enlarged 150 times.

When his botany class needs lantern slides of minute plants, Kirk L. Truman, San Francisco, Calif., high school student, makes them. He designed and put together an ingenious homemade outfit for enlarging plant life 150 times and photographing the result, using materials to be found in any modern high school.

First he obtained a standard laboratory microscope, such as is used in science classes. He tilted it to a horizontal position and fitted its eyepiece into a cardboard collar that was substituted for the lens of an ordinary view camera. A stereopticon furnished the light. Focusing was done on the regular ground glass panel of the camera.

PHOTOS SHOW NEPTUNE HAS SIXTEEN-HOUR DAY

Astronomers at the Lick Observatory, Mount Hamilton, Calif., recently learned that the planet Neptune rotates in the same direction as the earth and has a day about sixteen hours long. They made the discovery by holding a camera trained on the equator of the planet for hours and studying the light on each side of its center with a spectroscope. The study showed that one side was approaching, while the other was receding, and further observations determined the speed of rotation.

The magnitude of the task is appreciated when it is realized that even in a large telescope Neptune appears as a pin point of light, and the scientists had to photograph but a minute strip of its surface. The camera was mounted on a telescope that was spotted on the target 2,800,000,000 miles away and held there unwaveringly by intricate machinery.

NEW STAR FOUND BY GERMAN STAGE STAR

A "star" of the stage found a new star in the heavens at Berlin, Germany, the other night. While Heinrich George, noted German actor and author, was scanning the sky from his private observatory, he chanced upon a pin point of light that his star map failed to indicate. He reported his discovery to the German Astronomical Society. That body confirmed the fact that George's star was a new one to astronomers.

Heinrich George, German actor-author, in his observatory, where he found a new star.

NO FIRE IS NEAR AS RADIO POPS CORN

This corn, between glass jars packed with ice, was popped by radio waves from a "fever machine" which heated it internally.

Popping corn by radio was demonstrated in New York the other day by General Electric engineers. A glassful of popcorn, crackling and bursting with no stove near, popped in two minutes. Not a kernel was charred.

On each side of the popcorn was an electric wire in a glass with ice cubes to prove it was cold. Short radio waves passed between the wires and induced electric currents in the corn, heating it internally. The wires were connected to a radio "artificial fever machine" developed several months ago (P. S. M., Sept. '30, p. 32) to combat disease by heating a patient's blood internally just as it popped the corn.

NEW MICROSCOPE USES INVISIBLE LIGHT

A new way to take photomicrographs by invisible ultra-violet rays, developed by a Rochester, N. Y., camera firm and an optical manufacturer of the same city, makes it possible to use ordinary glass lenses in the microscope.

Photomicrography with ultra-violet rays is not new. The most highly magnified photographs in the world are made with these invisible rays, and pictures taken at the Bell Telephone Laboratories, where the process was originally perfected, have been made with magnifications of 6,000 diameters. Hitherto, however, expensive quartz lenses have been needed.

Now the Rochester experimenters have found a way to use ultra-violet rays so nearly resembling visible light that they will pass through glass. Tests showed that pictures could be made magnified a fifth again as much as those taken with ordinary light. One of the most successful pictures showed a grain of hollyhock pollen so enlarged that a vague gray ring around it, as seen by visible light, became a clear circle of spines. One specimen of a worm could not be photographed in the new way because its body contained a layer that stopped ultra-violet rays.

Effort Now Being Made to Solve Mystery of Northern Lights

Here is the spectroscope at the Tromso, Norway, aurora observatory to analyze the light.

From this bleak hilltop near Tromso, Norway, a painstaking study of the mysterious aurora is being made.

When the northern lights flame up into the sky, the camera gets busy and on its plates are pictured streamers like this.

WHAT are the northern lights, those luminous flashes in the sky that seem to come from the Arctic horizon? Solving their mysteries is a task that observers in fur coats have set themselves at the northernmost observatory in the world.

On a bleak hill not far from the town of Tromso, Norway, a concrete platform has been raised with the aid of American contributions and funds from the Norwegian government. Strange looking instruments roll out upon it at the approach of an auroral display, and are manned by men under the direction of Prof. Lars Vegard, noted Norwegian physicist.

They have a grandstand seat at one of Nature's most gorgeous spectacles. For every one display of northern lights that is visible as far south as the middle of the United States, these observers see ten.

White or yellow auroras are most common. Rosy carmine is an occasional hue, and one brilliant aurora of this kind was mistaken for a conflagration not long ago and called out a fire brigade in Salzburg, Austria. When green or red rays shoot across the sky, compasses become agitated, revealing the strange magnetic disturbances that disrupt telegraph and radio service. Blue or violet tints, seen by some observers in auroras, are extremely rare even in the very high latitudes.

One man at the Tromso observatory works the spectroscope, a bulky box that analyzes the color of the aurora's light. Another watches an instrument, resembling a compass in principle, that charts the magnetic disturbance. A camera man photographs the aurora with the fastest lens and most sensitive plates known, because even the most brilliant aurora is weak in candlepower.

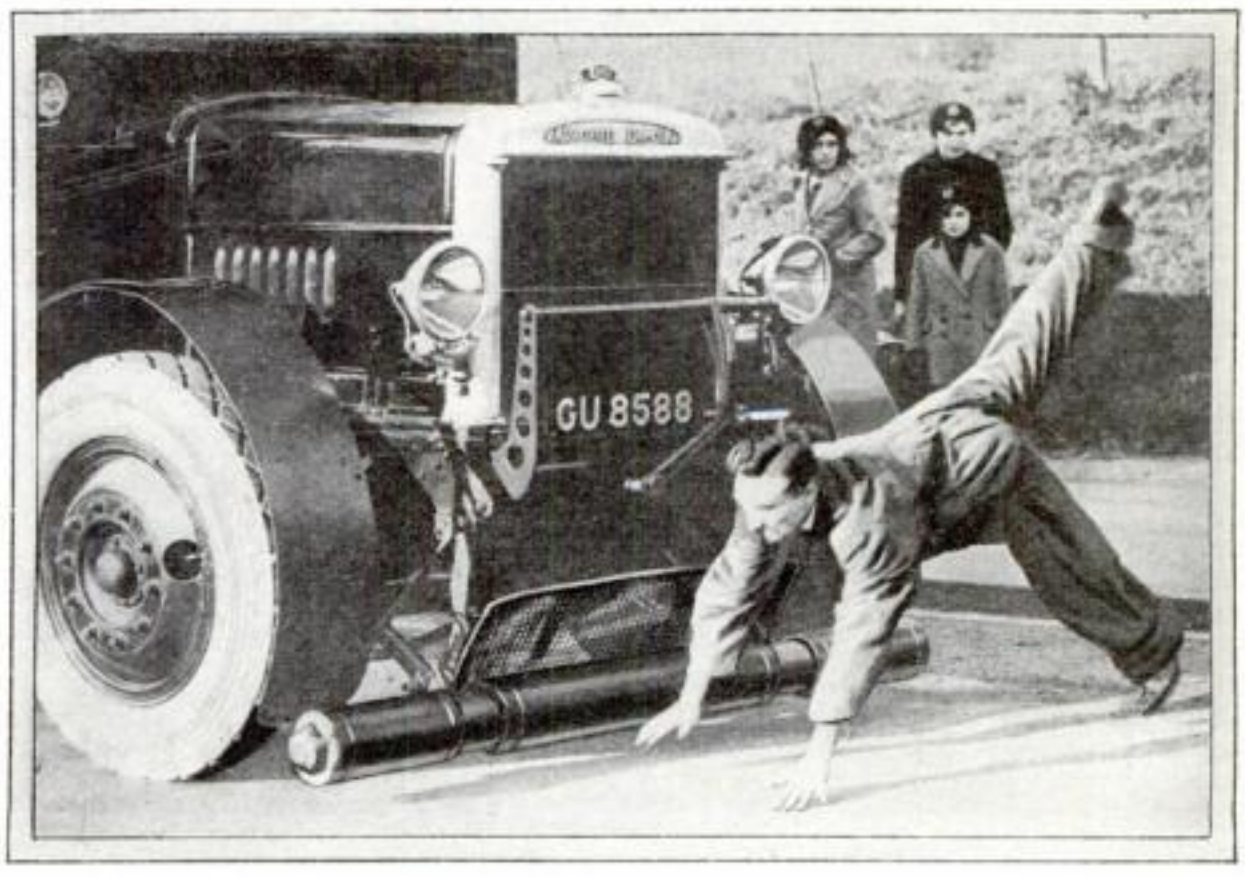
A fourth observer takes sights to determine its height. He is in communication by telephone with another observer taking sights from a vantage point several miles away, so that the height can be found by the method familiarly known as "triangulation."

From such observations it is already known that most auroras are sixty to seventy miles above the earth. Some of their streamers may extend as high as 600 miles or more. There are a very few cases, seemingly authentic, when auroras have been seen close to the earth.

Such observations are unexplained by the theory that auroras are the glow of rarefied gases in the upper air, bombarded by electrons from the sun.

FRONT ROLLER ON TRUCK PREVENTS ACCIDENTS

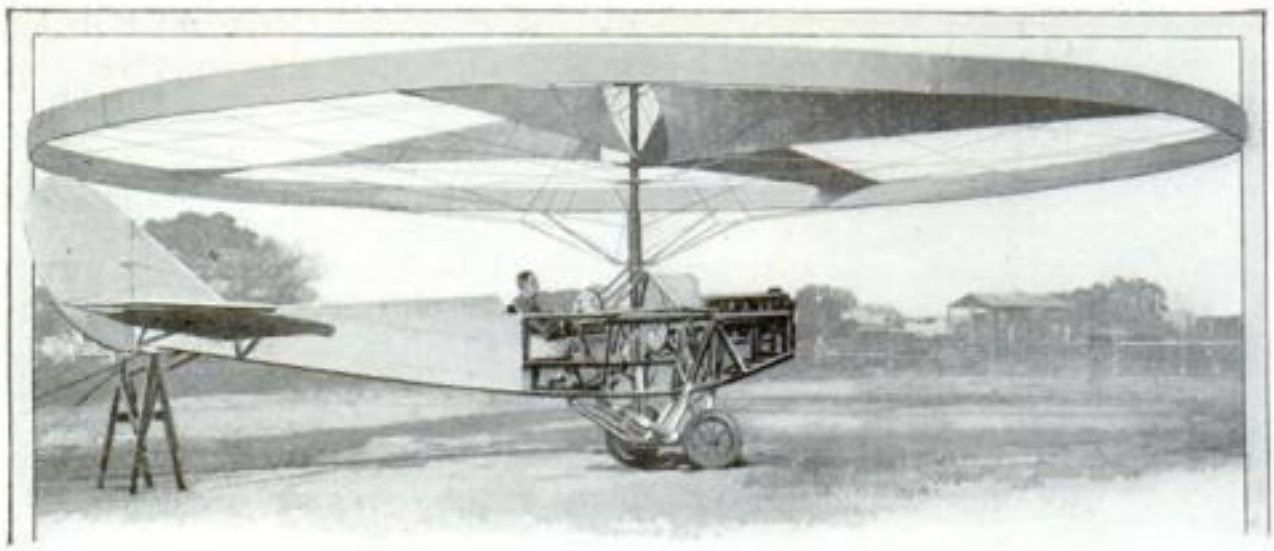
DESIGNED to prevent pedestrians from being run over, a British motor truck has a large roller before its front wheels, which rotates in the opposite direction to the wheels. If a person is knocked down the tires cannot touch him, since the roller's reverse rotation throws him away from the vehicle. It thus has time to stop before doing him serious injury.



A roller in front of this truck revolves in the opposite direction to that of the wheels and thus tosses a human body out of the way and gives the driver a chance to stop his car.

SNOW MOSQUITOES SLEEP THROUGH THE WINTER

MOSQUITOES that sleep all winter inhabit the northern ranges of the Rocky Mountains in Montana. They pick out homes under rocks and logs and doze through the cold weather, buzzing out on the first warm day of spring. They are called "snow mosquitoes," and grow large, having spotted wings. During the summer they store up fat, on which they subsist during winter. When they come out in the spring, they are lean and hungry.



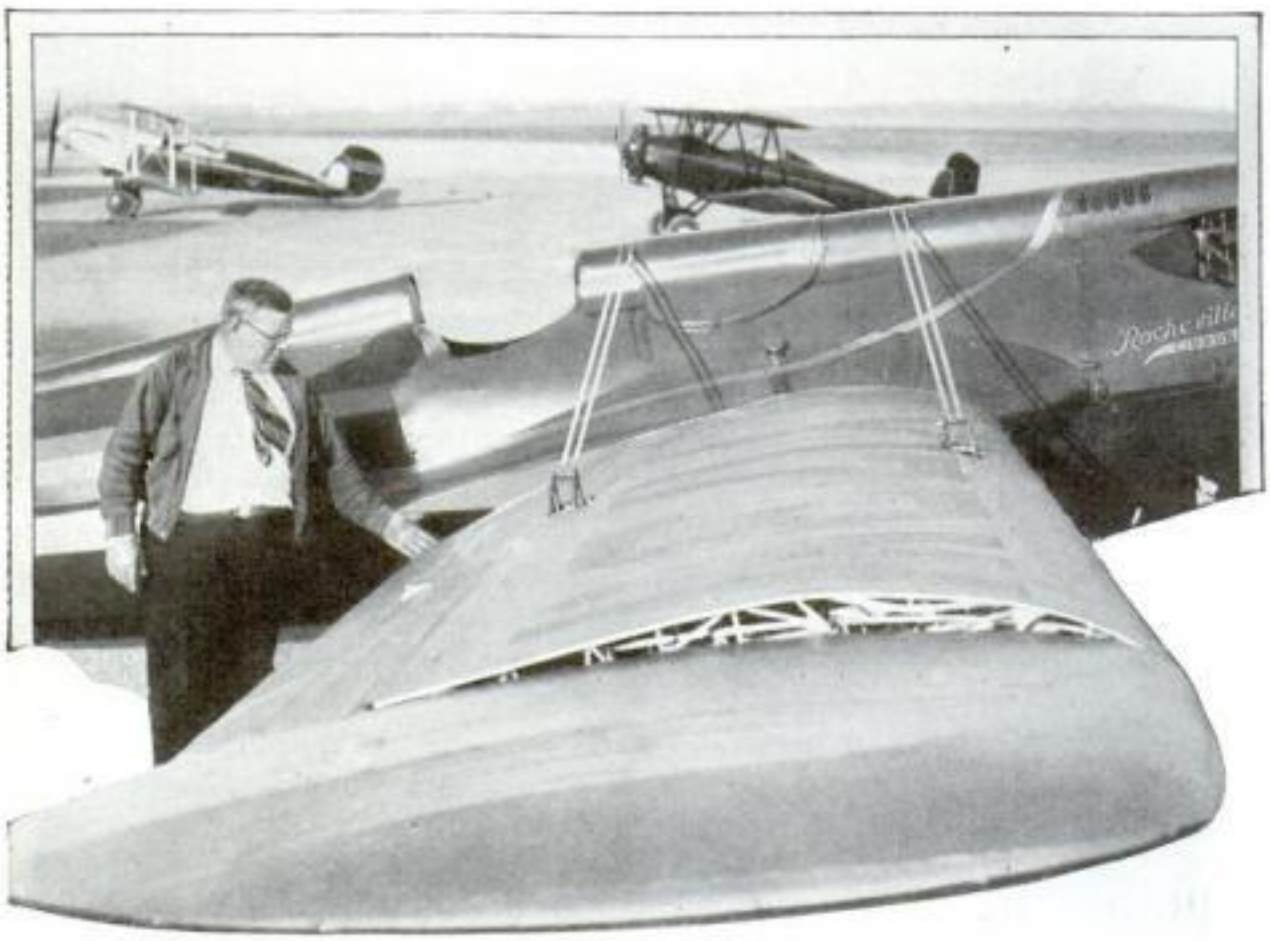
PROPELLER MAY LIFT PLANE STRAIGHT UP

MOUNTED on a vertical shaft, a huge propeller may lift a strange looking aircraft straight up in the air, according to its inventor, who hopes to try out his machine soon. An ordinary airplane engine supplies power for driving both this device and the usual airplane propeller mounted on the nose of the ship. The large "helicopter" propeller is driven by "friction disks," two wheels with smooth surfaces, one turning the other by being pressed against it. One is mounted on the engine's horizontal shaft and the other on the vertical shaft, forming a right-angle drive. Similar drives were used on motor cars in the early days of the automobile before shifting gears came into fashion.

AIR MAIL TO EUROPE, 1932

UNITED STATES air mail to Europe may start in 1932, by way of Bermuda and the Azores. By the time this issue of the magazine appears, the Post Office Department will have asked for bids for an all-American route across the Atlantic.

Service as far as Bermuda would begin, according to the plan, next June first.



ADJUSTABLE WING AIDS PLANE LANDING

A NEW airplane wing developed in Los Angeles by H. D. Rocheville has been tested successfully in flight. The pilot can, by turning a crank in the cockpit, regulate its shape to suit flying conditions. For slow landing speeds and quick take-offs he can "thicken" the wing, automatically increasing its angle and lifting capacity. For high-speed flight he can, by the same means, flatten the wing, decreasing its lifting capacity but increasing its speed by reducing wind resistance. In either shape of wing the plane handles easily, and the adjustable wing helps in sudden storms.

Rocheville, who designed the new wing and is seen above pointing to the bulge that is supposed to make the plane safer and more easily managed, has been identified with aviation since 1912.

OPEN PASSENGER AIR LINE, NEW YORK TO CHICAGO

RECENTLY the first regular passenger line between New York and Chicago was opened. Hitherto considered a dangerous flying section, mail planes have carried passengers only by special arrangement. The new line's tri-motored, all-metal monoplanes cover the distance in six and a half hours.

BLIMP MOORED TO MAST ON TOP OF BIG BUS

FOR what is believed to be the first time in history, a lighter-than-air flying machine has been moored to a motor car. Officials of the Goodyear Rubber Company, experimenting with portable mooring devices for their blimps, rigged a small tripod mast on top of a bus. When their airship *Puritan* arrived at Washington recently they succeeded in mooring it to this traveling landing device. When not in use the mooring mast can be folded up on top of the bus so that it will in no way interfere with the normal operation of the car. The bus can be anchored if its weight is not sufficient to hold securely the gas-filled airship above it.

For the first time in history, an airship was moored recently to a mast on top of a bus.

NEW AIR MAIL FLAG SOON TO FLY AT AIRPORTS

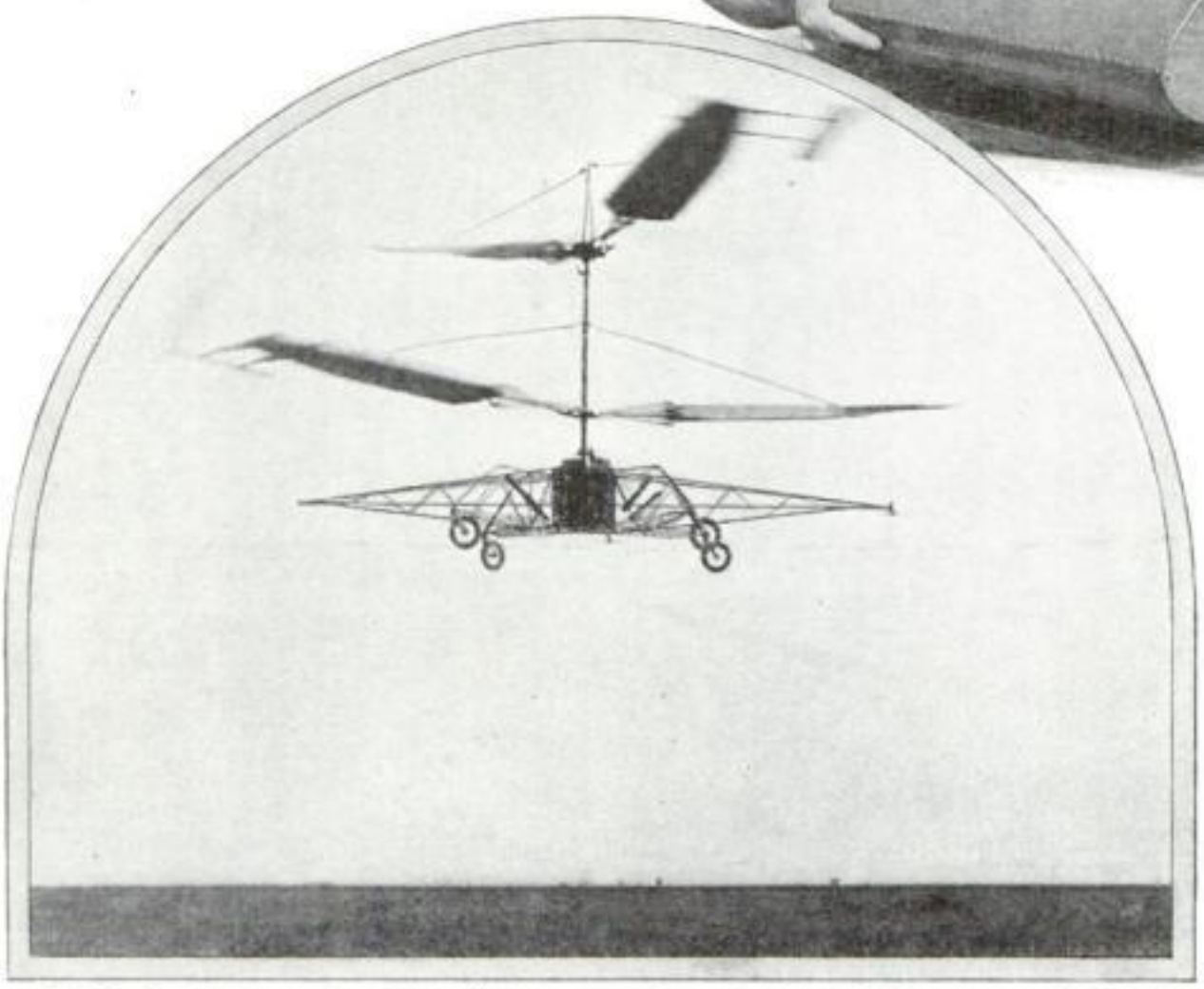
AN OFFICIAL air mail flag, recently adopted by postal authorities, soon will be hoisted over all airports at which United States mail is handled. Red, white, and blue stripes at its top and bottom edges resemble the markings on air mail envelopes.

On a central field of white, a device worked in gold represents a globe bearing the words "U. S. Air Mail," flanked by two wings. Colonel L. H. Brittin, of Northwest Airways, designed the flag, which was dedicated by Assistant Postmaster General Glover.

This new air mail flag, with red, white, and blue stripes, will fly at U. S. Mail fields.

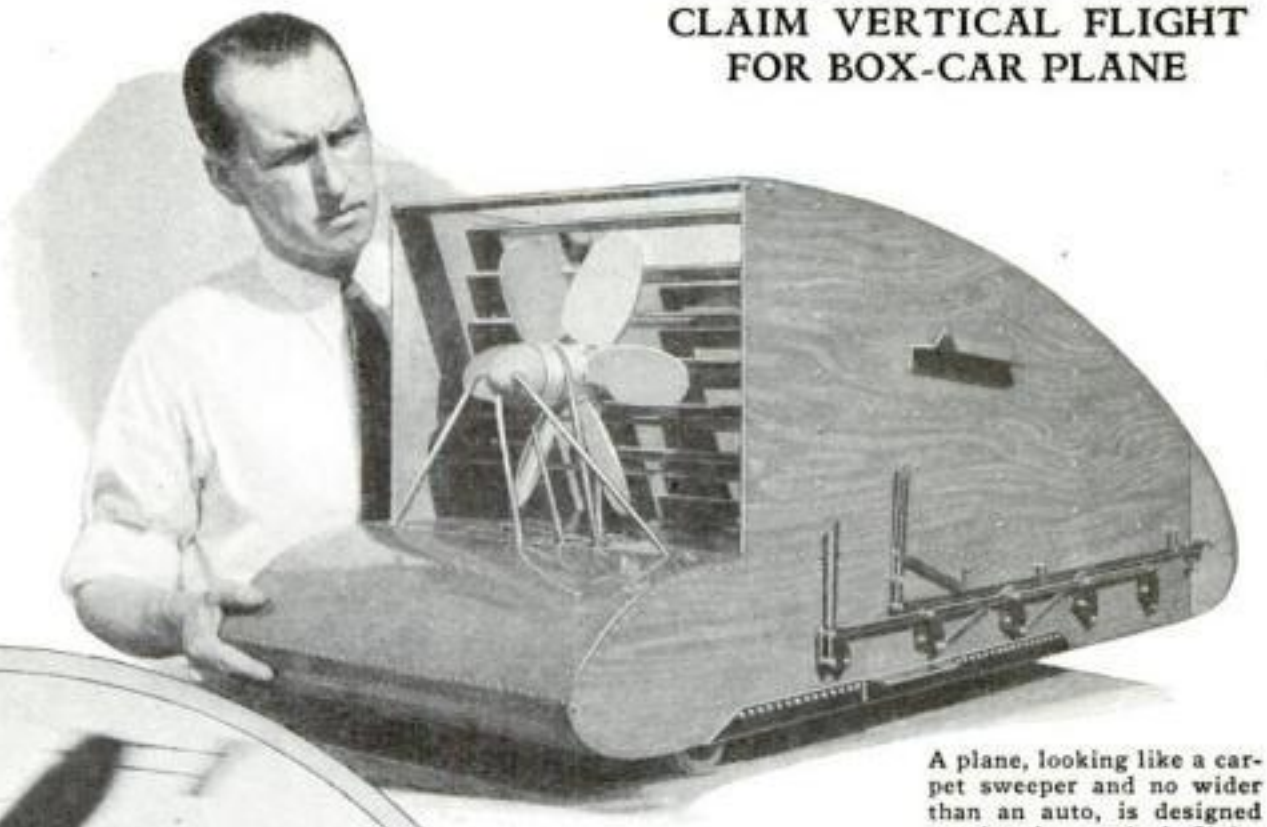
ITALIAN HELICOPTER RISES, HOVERS, FLIES

IN A recent issue of this magazine was illustrated a one-ton, ninety-horsepower Italian helicopter said to be capable of flying straight up (P. S. M., Oct. '30, p. 53). It was ordered by the Italian government in 1927, and completed last year. Now word comes from Italy that it accomplished the following record feats at the Clampino airport, near Rome: Ascended to a height of sixteen feet and hovered stationary for one minute, climbed to an altitude of fifty-eight feet and returned to a starting point indicated by a circle on the ground, and flew cross-country for nearly three fourths of a mile.



This Italian helicopter rises vertically, hovers stationary in air, and lights on a spot indicated by a circle on the ground. A super-machine of same design was ordered by the government.

CLAIM VERTICAL FLIGHT FOR BOX-CAR PLANE

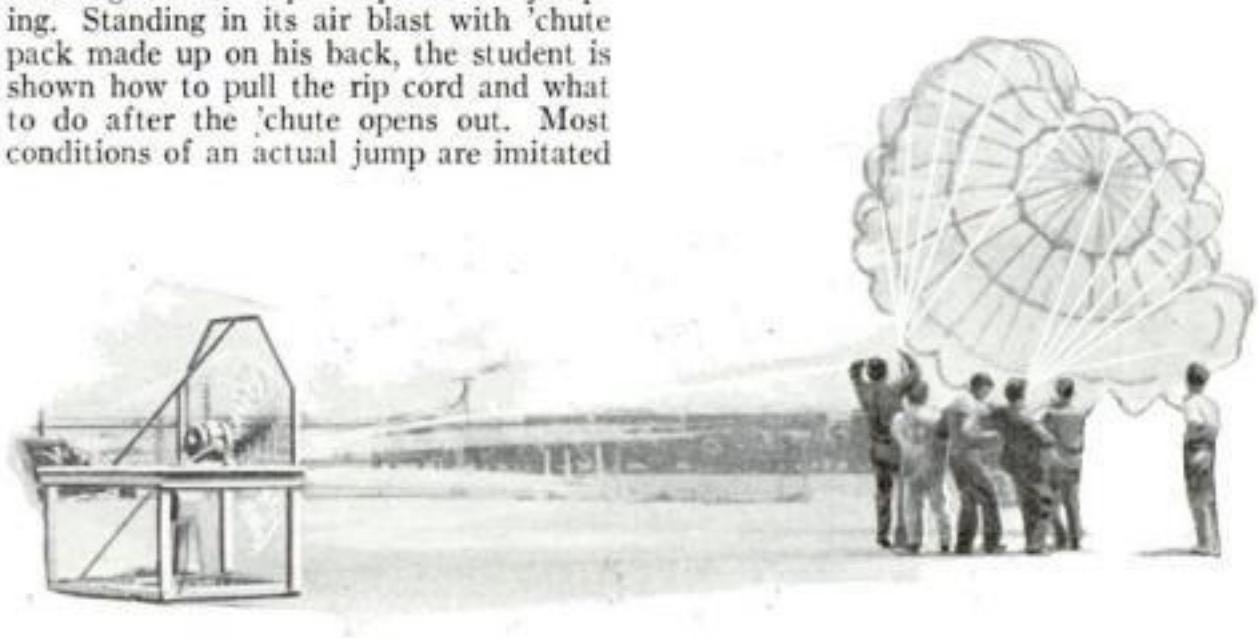


A plane, looking like a carpet sweeper and no wider than an auto, is designed to rise in vertical flight.

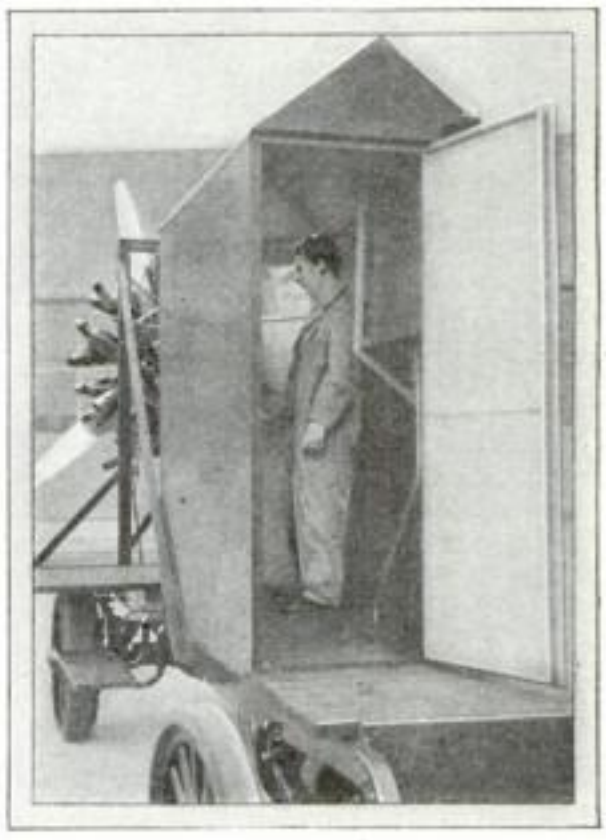
COMPACT and massive-looking, a strange aircraft model with which Glendale, Calif., plane designers are experimenting in no way resembles the graceful planes now in use. This "flying carpet sweeper," so called from its unusual appearance, is said to be able to alight on and take off from water or land and be capable of vertical flight or hovering motionless in mid-air. Since its width is no greater than a motor truck it is believed to be able to operate on public highways. The plans from which the model was built were for a freight plane.

PARACHUTE JUMPING NOW TAUGHT ON THE GROUND

INSTRUCTORS at a California air school rigged up a portable airplane propeller, driven by an electric motor, to aid in teaching the technique of parachute jumping. Standing in its air blast with 'chute pack made up on his back, the student is shown how to pull the rip cord and what to do after the 'chute opens out. Most conditions of an actual jump are imitated by the machine without submitting green students to the risk of leaping from actual planes in flight. Having mastered the technique of pulling the cord and keeping their heads, the danger incident to a real jump is greatly reduced.



Learning to pull the rip cord of a parachute is no longer dangerous, as a blast of air from a propeller inflates the 'chute and suggests actual conditions of jumping.



AIRPLANE MOTORS NOW TESTED ON A TRUCK

A STAND for testing airplane motors, recently completed in Portland, Ore., resembles a queer-looking aerial propeller driven vehicle. A steel framework is built at one end of a truck, the other end of which is occupied by a small house in which the operator works.

After an overhaul, airplane engines are given a twenty-hour shop test by running them in the plane. This wear and tear of the plane will be eliminated by use of the new testing stand.

FIRST ROCKET AIRDROME OPENED NEAR BERLIN

EVIDENCE of the seriousness with which German aeronautical authorities are taking rocket flight is shown by the opening of the first rocket airdrome, an experimental station near Berlin. On a tract of land a mile and a half square and equipped with laboratories and workshops, engineers are experimenting with a means of flight with which they hope ultimately to shoot mail to America in six hours.

TAILLESS GERMAN PLANE SEEMS TO FLY BACKWARD

German plane, with wing for tail, looks as though it flew with nose behind it.

A NEW German plane is without the ordinary tail. A small wing, equipped with ailerons, is mounted on an extension of the fuselage ahead of the main wing. In the air, it looks as if it were flying backwards. The auxiliary wing gives its nose the appearance of the tail on airplanes of standard design.

It has a rudder, much like those on other planes, mounted close behind the main wing. Two small stabilizing vanes are placed under the main wing on either side of the fuselage. The machine is a twin-engined cabin type craft. Early Curtiss and Wright airplanes were fitted with a bow extension for stabilizers and elevators in a manner somewhat like the nose wing of this plane.

OLD PLANES DESTROYED BY BOMBS FROM AIR

OLD planes have been used recently by the Army as aerial bombing targets. The obsolete machines were arranged to represent an enemy squadron upon its landing field. Army bombers were ordered to wipe them out during recent maneuvers near Camp Stanley, Texas.

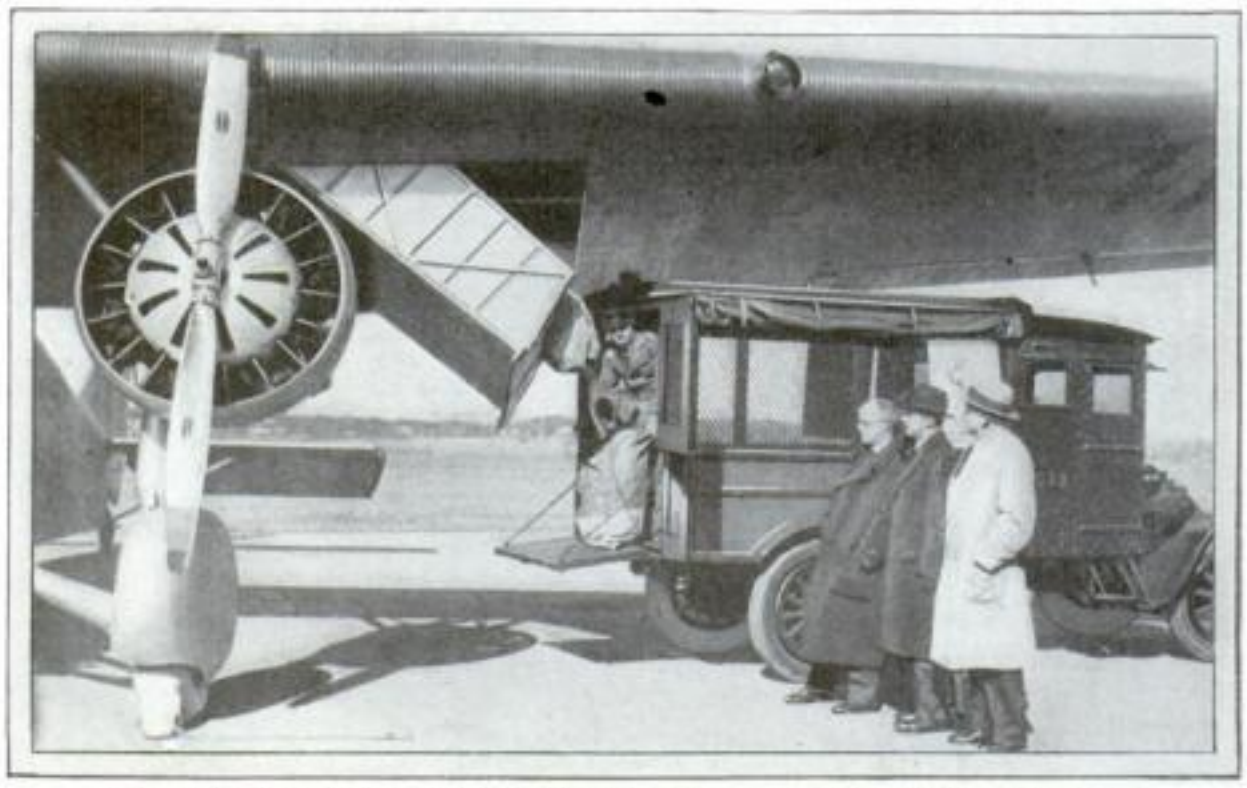
Modern bombers swept over the field, dropping their deadly missiles on the lines of "enemy" planes on the ground. One after another they were hit, bursting into flames.

The picture at the left shows the bombing planes sweeping above the derelicts and dropping the explosives.

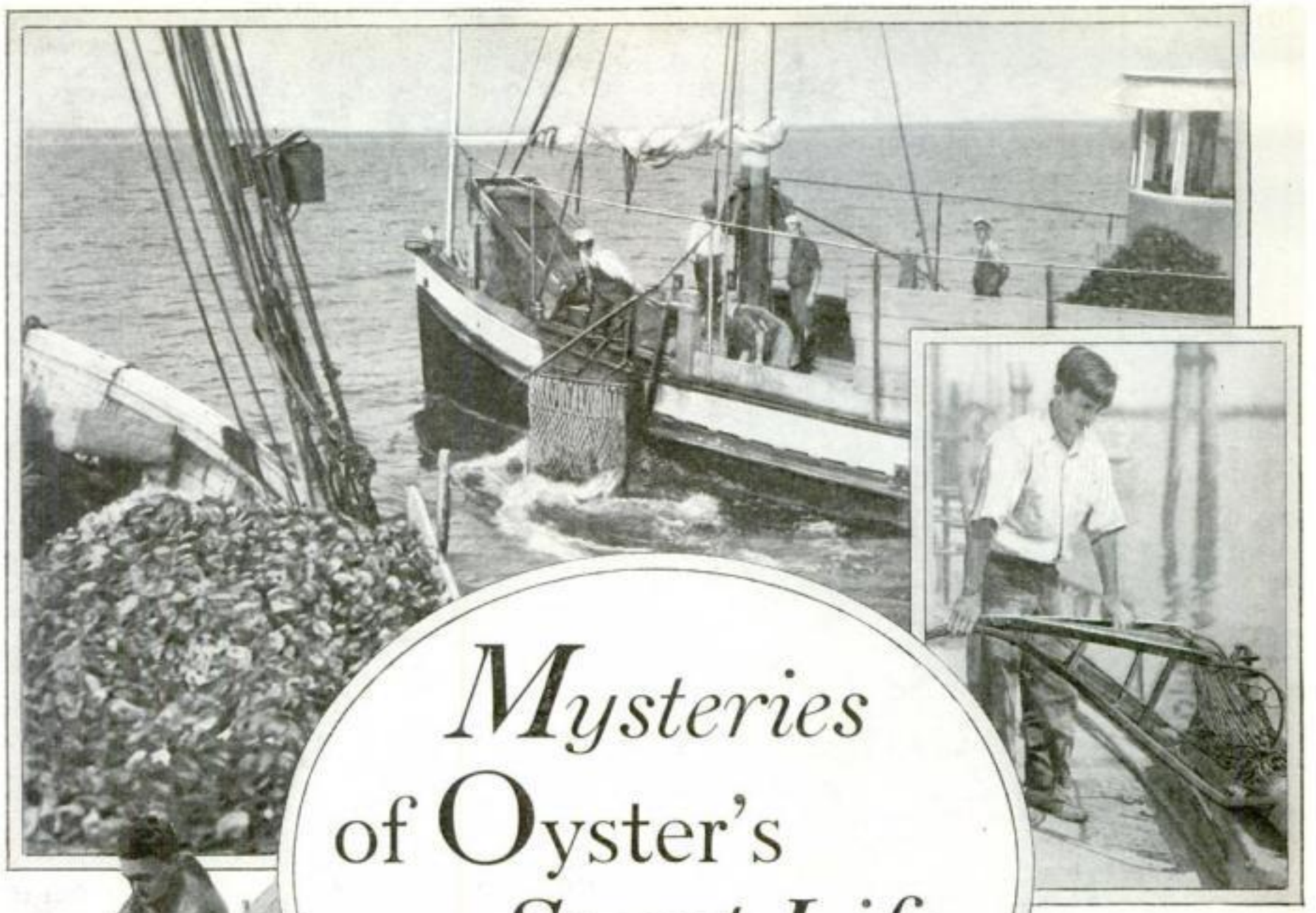
MAIL NOW CARRIED IN AIRPLANE'S WINGS

How can more space be found in an airplane for mail bags? That question has been raised by the fact that the air mail volume has enormously increased during the past few months. As one answer, Post Office officials have suggested that mail bags can be carried in the wings of a plane. As a result of this proposal, the Ford all-metal plane, at right, has been developed with a hinged section between the ribs on the underside of the wings. It is raised and lowered by cables that work on a winding drum, which in turn is operated by a portable crank handle resembling, in appearance, a carpenter's long brace, and giving sufficient leverage to move the section even when it is loaded.

A mail truck can back up to the plane and the sacks can be loaded directly into the wing space. As planes are constantly being built larger and larger, with a consequent increased depth of wing, designers are tending more and more to make use of the inside of the wings as passenger and freight space.



All-metal Ford plane developed with hinged section in each wing into which mail bags can be packed. Increased volume makes necessary more space for mail.



Mysteries of Oyster's *Secret Life* Are Solved

A close-up of the machine that drags loaded oyster nets to deck of fishing boats. Top photo: Bivalves being loaded on boats at Northport, L. I.

By

JOHN E. LODGE

Dr. Paul S. Galtsoff in the oyster investigation laboratory and, upper left, ready to go down in a diving bell to study bivalves.

THIRTY centuries ago the Chinese were cultivating oysters. Indians were eating them as a delicacy before Columbus discovered America, and there is reason to believe that prehistoric man valued them for food. Yet, only within the last half-dozen years has any serious effort been made by scientists to plumb the life secrets of this mysterious mollusk.

Recently, many new facts have been uncovered about its curious manner of reproduction and the strange, almost plantlike existence it leads. Laboratory tests show that it stays "awake" about eighteen hours a day, that the female may lay 500,000,000 eggs a year, and that, deprived of locomotion, hearing, and sight, the oyster possesses a sense of taste four times as efficient as that of man.

Much of this work of discovery has been done under the direction of Dr. Paul S. Galtsoff, in charge of the oyster investigation division of the U. S. Bureau of Fisheries, Washington, D. C. For more than four years, he has been devoting all his time to the study of the habits and problems of this marine animal that, in America alone, produces $25,000,000 worth of food a year and supplies work for an army of 65,000 persons.

The revelation of the oyster's private life started with the specific problem of improving oyster beds. Seeking sound scientific foundation for this work, Dr. Galtsoff undertook a thorough study of the oyster and its ways. In general, the life history of the oyster was known. But that history fairly bristled with question marks.

IT WAS early understood that the female discharges its eggs directly into the sea, as the male does its sperm, and that haphazard fertilization takes place in the water. The European oyster, and, it is believed, some species on the Pacific coast of America, can change sex, at one time being male and at another female.

In five or six hours, the fertilized eggs develop into microscopic free-swimming larvae that in twenty-four hours grow thin bivalve shells and soon afterwards settle upon objects in the water and cement themselves in place.

These young oysters are known as

Experimental oysters are arranged in storage tank for future use.

"spat," and the settling process is called a "spatfall." The spatfall takes place usually on the muddy flats between high and low tide marks where the tiny mollusks cover every solid object like swarming bees.

TO PROVIDE suitable resting places for the spat, oyster men scatter "cultch"—clean shells, stones, and branches—in the water. As many as 15,000 spat have been known to cement themselves to a half bushel of shells. Recently, the Bureau of Fisheries demonstrated that shells inclosed in chicken wire, so that they form masses that look like logs, allow from ten to a hundred times as many young oysters to grow on the same area of bottom.

The spat soon develop adult organs and then begin filtering sea water, straining out the microscopic plants and animals which form their food, growing into "seed" oysters that are planted in beds to be fattened for the market later on.

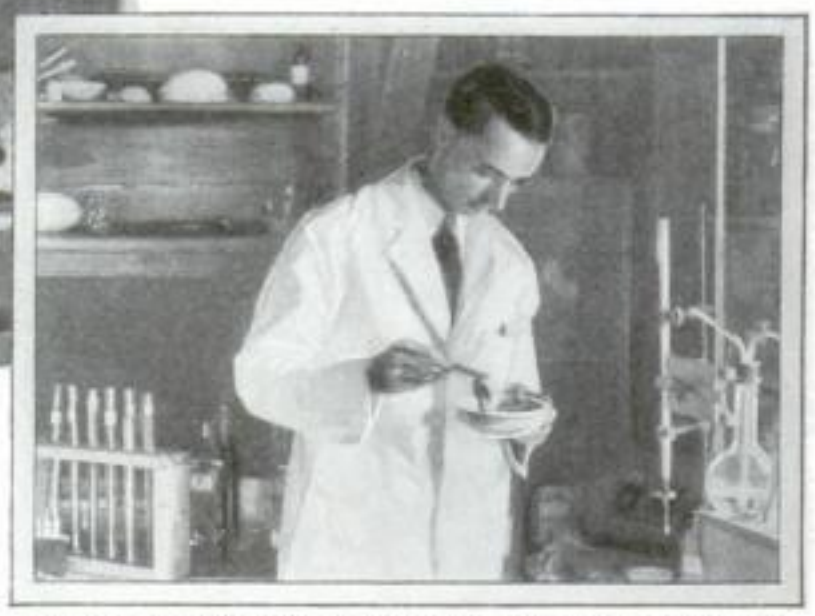
While these facts were known, many things about this life cycle remained unknown. How many eggs does a female oyster produce in a year? What is the effect of changes of water temperature? How much sea water does an adult oyster filter through its body to obtain its food? Can an oyster detect different chemicals in the water? How many hours a day does an oyster "work"? These questions Dr. Galtsoff and his associates set out to clear up. And ingenious were the methods by which they were answered.

To obtain an accurate estimate of the number of eggs a female oyster discharges, Dr. Galtsoff placed several specimens, with their bodies full of eggs, in tanks of sea water. By raising the temperature, he induced them to spawn. An instrument, attached to the oyster, recorded on a graph the rhythmic muscular contractions that accompany each discharge of eggs.

AS SOON as the device showed that the spawning had ceased, Dr. Galtsoff stirred the water in the tank vigorously in order to distribute the eggs uniformly through it. Then a sample was taken and the eggs filtered out and then counted.

Thirteen tests were made. The smallest number of eggs discharged by one oyster was 11,000,000. The largest number was 114,800,000. As one female may spawn from five to six times in a season, Dr. Galtsoff estimates that a single oyster may produce 500,000,000 eggs a year. If every oyster egg produced an adult oyster, the cumulative process would cover the globe miles deep with oyster shells in the span of a human lifetime.

But the mortality of larvae and spat is high. Small fish gobble them up. Starfish, marine borers, and jellyfish prey upon them. Also it has been discovered lately that the temperature of the sea water has a definite bearing upon whether there will be a good or a bad spatfall. If the water is exceptionally cold during the spring months, it can be definitely predicted that the spatfall for the year will not be as good as when the water is warmer.



In this bacteriological laboratory, investigation brings to light the tiny oyster parasites that may be disease spreaders.

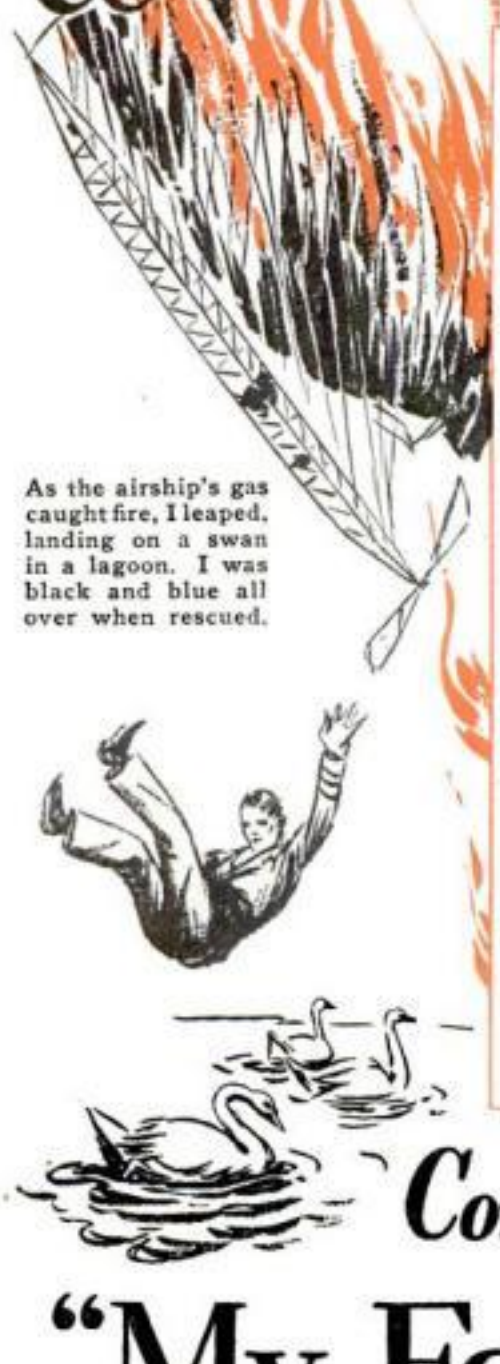
ANOTHER example of the important part the temperature of the sea water plays in the life of the oyster was discovered by the experimenters. It was found that spawning never begins until the temperature rises to sixty-eight or seventy degrees Fahrenheit. The main reason oysters are sold only in "R" months is that in warm weather, when they are breeding, the taste is poor. A new process of freezing, recently announced by the Bureau of Fisheries, may make possible all-year-'round consumption of this favorite seafood.

One of the most important events in the life cycle of an oyster is when the spat begins to cement itself to some solid object. Inability to set properly is a condition often encountered in northern waters. Recently, H. F. Prytherch, one of Dr. Galtsoff's associates, made a startling discovery which may have far-reaching effect. He found that a minute amount of copper added to the sea water increases the ability of the microscopic larvae to set. This amount is so small that dangling a copper penny in a tank for a minute, I was told, will increase the cementing power of the larvae. Settings have been induced in water that had as little as one part copper to fifty million parts water.

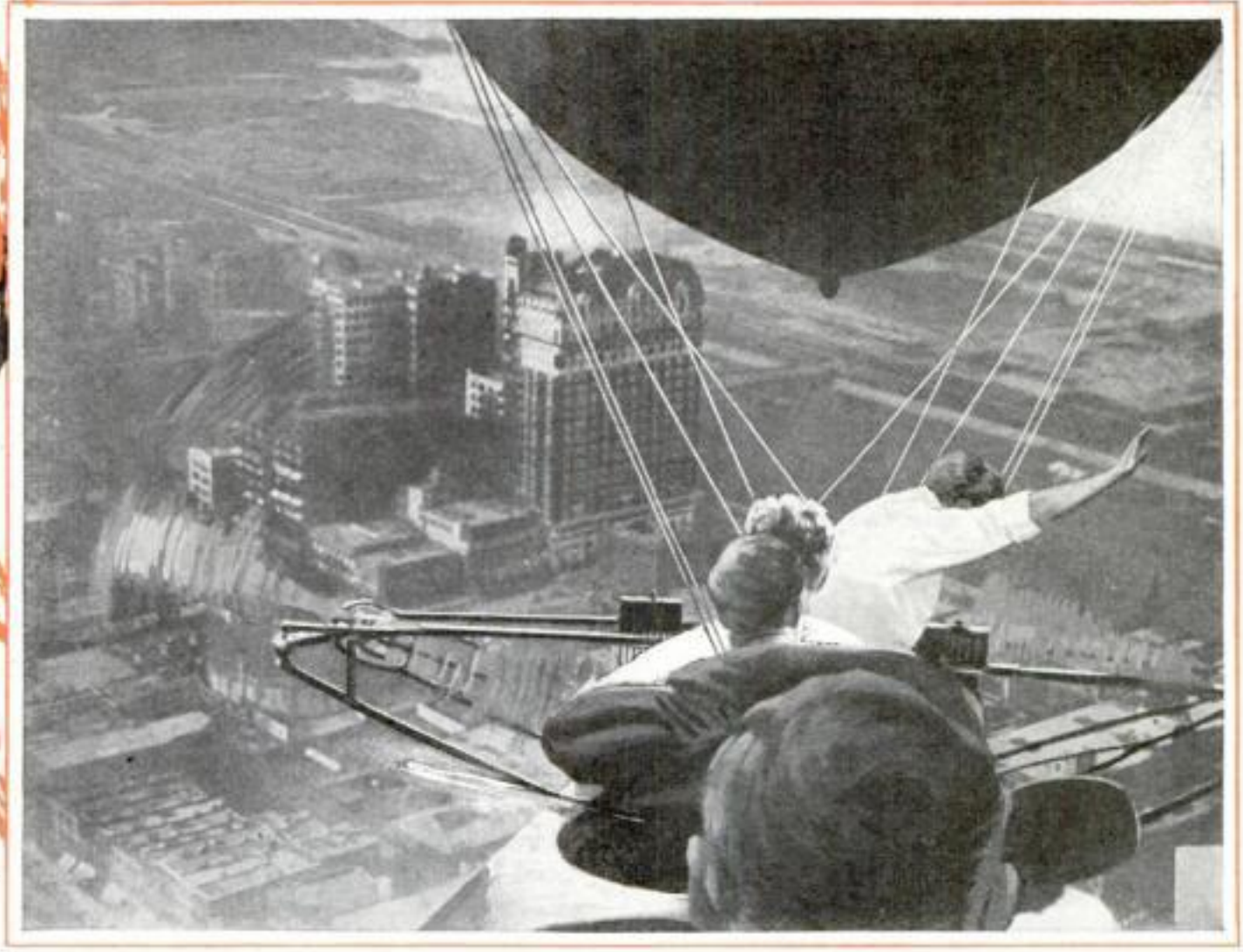
However, larger amounts of copper in sea water are distinctly harmful to oysters. In Long Island Sound, of late years, oyster men have been troubled with "green" oysters—specimens of dark hue and unpleasant taste. *(Continued on page 148)*

Keeping oyster larvae free of disease germs is a problem that the Government experimenters have attacked. Into these jars go the larvae over whose growth careful watch is kept.

When Airships Were Death Traps



As the airship's gas caught fire, I leaped, landing on a swan in a lagoon. I was black and blue all over when rescued.



Concluding the Thrilling Story of

"My Forty Years of Flying"

By CAPTAIN HORACE B. WILD

MY MOST thrilling thirty seconds in the air was experienced at Tampa, Florida, in February, 1907. I was flying a "rubber cow," as we called the early dirigibles, at 200 feet when a gasoline connection broke, the fuel ignited, and flames shot toward the gas bag, filled with 10,000 cubic feet of hydrogen which when mixed with air is as dangerous as T. N. T.

I was riding on a frail wood and wire framework slung beneath the balloon. Sliding toward the engine, I tried to smother the blaze. My gloves and cap caught fire, burning my hands. The gasoline pipe, swinging from side to side, spouted flame like a blowtorch. Overhead, blisters were puffing out on the brown silk of the gas bag. The explosion was a matter of seconds.

While hydrogen must be mixed with air to burn, the envelope leaked sufficiently to be surrounded with a ring of igniting mixture. A circle of fire shot up the bag. In a flash, the envelope was a mass of roaring, shooting flames. I leaped out into space, 200 feet from the ground. As I jumped, the hooks on one of my high-topped shoes caught in the netting. For a split second I dangled head downward

RIDING in dirigibles above big crowds twenty-three years ago, Captain Wild and other daring aviators made America air-minded with their stunting done at the risk of life and limb.

Absolutely blind, I flew a dirigible guided only by a siren on a wagon.

before I kicked myself free and somersaulted through the air.

The dirigible was flying over a park when the connection broke. When I jumped, it was directly above a lagoon in which a score of big white swans floated.

As I fell, I heard a terrific detonation and saw flames shooting in all directions above me. Then I struck. I landed in a sitting position directly on top of one of the swans, and an instant later struck the mud at the bottom of the pond. Just as I bobbed to the surface, the heavy motor and the flaming center section of the framework crashed into the lagoon not twenty feet away. When I was pulled out I was black and blue from my ears to my heels but without a bone broken. I ate my meals standing up for months afterwards. The miracle of being above that tiny pond saved my life.

CARRIED by the wind, pieces of the flaming gas bag fell among the barns of a large race track near by, starting a fire in which twenty horses perished. When I finished paying the bills, I was cleaned out. I had come to Tampa in a private car, with $22,000 in the bank. I left with my wife, baby, and a gripsack, thankful to be alive.

Fire was a menace that pilots constantly dreaded on the early airships. The sputtering, backfiring gasoline engines of 1907 were a continual source of danger. Explosive hydrogen was the only lifting gas we had. Helium, now used, cost from $1,700 to $2,000 a cubic foot before the

Buffeted about in a Chicago blizzard, the framework of *The Comet* struck a roof and tobogganed down into a vacant lot next door.

At right, Captain Wild starting in the dirigible race at St. Louis, 1907. His magneto wires jarred loose and his ship drifted away, landing in a distant field.

At Sioux City, Iowa, in 1907, Wild raced his *Comet* against the great pacer, Dan Patch, who won easily. Dan Patch is seen blanketed, in front of stand.

Young Dixon's mother, following flight in auto, found him in Illinois.

Cromwell Dixon, 13, built his own dirigible and powered it with bicycle pedals attached to a tin propeller. He flew at St. Louis meet, in 1907.

war. Large supplies recently discovered in Texas and Kansas have reduced the price per cubic foot to three cents, and last year 8,000,000 cubic feet were produced for dirigible use. It will require 6,500,000 cubic feet of this gas for one filling of the gigantic containers of the *Akron*, the U. S. Navy's big airship now being completed in Ohio.

Little did I dream, when I was barnstorming through this state in 1906-7, that less than a quarter of a century later the world's biggest building would be erected on the outskirts of Akron to shelter an airship 650 times as big as the dirigible I flew.

At the banquet held in New York to celebrate the *Graf Zeppelin's* round-the-world flight last year, Dr. Hugo Eckener, the commander, with whom I had flown long before the war, told me that it is only a matter of a few years until skyliners will leave for distant parts with the regularity of ocean steamboats. His fondest dream, which he predicts will become a reality in 1945, is a Zeppelin holding 20,000,000 cubic feet of helium, carrying 1,000 passengers and propelled by motors totaling 25,000 horsepower.

ANOTHER flight, almost as nerve-straining as the one at Tampa, took place at Anderson, N. C., on August 6, 1910. I was just recovering from injuries sustained in an airplane crash at Galesburg, Ill., when I received an offer of $2,000 to fly a dirigible over the southern city. I jumped at the chance and wired my acceptance.

On the train down there, I was looking out the window when everything turned black. I had gone blind as a result of the nervous shock. For months, I couldn't see my hand before my face. The committee at Anderson asked me what I was going to do. I said I was going to fly the dirigible. And I did fly it without ever seeing the ground, piloting the "rubber cow" with my ears.

An assistant mounted a fire siren on a buggy and drove from the ball park, where the airship was filled, across the center of town, around the outskirts, and back to the starting point, keeping the siren going all the time. With the dirigible at about 500 feet, I followed the sound. When I got back to the ball park, I circled around the point where the siren was screaming, coming lower and lower. When I was within 100 feet of the ground, the siren stopped and the assistant called: "Throw down your dragrope." I dropped the long rope overboard. It was caught and I was hauled safely to earth.

Captain Wild, center, and his crew with *The Comet* at the Indiana State Fair in 1906. At right, the big tanks in which sulphuric acid, iron filings, and water were mixed to generate hydrogen.

That was the first guided "blind" flight of history. Last month, I rode from New York to Chicago with a night air mail pilot who flew most of the way guided by invisible radio waves. As we roared through the darkness at two miles a minute, I recalled how I had groped my way at ten miles an hour following the sound of a siren twenty years before.

In 1908 newspapers all over the country printed, as a "startling prophecy," my statement that twenty years from that date mail would be transported from coast to coast in airplanes. On July 1, 1924, four years previous to the time set by me sixteen years before, the prophecy came true.

On another occasion when I made a "blind" dirigible flight, the difficulty was that I could see too well. I took off at Terre Haute, Ind., late in the afternoon. We usually gave our exhibitions between five and six, when the air was perfectly calm. When we flew at fairs, the programs always announced: "Dirigible Flight at Favorable Hour!"

THIS time, I was circling over the Wabash River when the engine gave a sneeze or two and went dead. I drifted like a balloon and landed on the roof of a junkyard shed. It was after dark when I got the balky motor in good humor and started back for the fair grounds. All the street lamps were lit. The thousand glittering points of light confused me. I started in the wrong direction, got lost, landed again.

My manager drove up. He always followed me in a wagon to haul the airship home if the gas leaked out. We decided on a plan. He drove off with red flares sputtering at the rear of the wagon. From the air, I followed this one-man torchlight procession through the heart of town to the starting point. Just as we arrived, the propeller struck the top of a tree and snapped off.

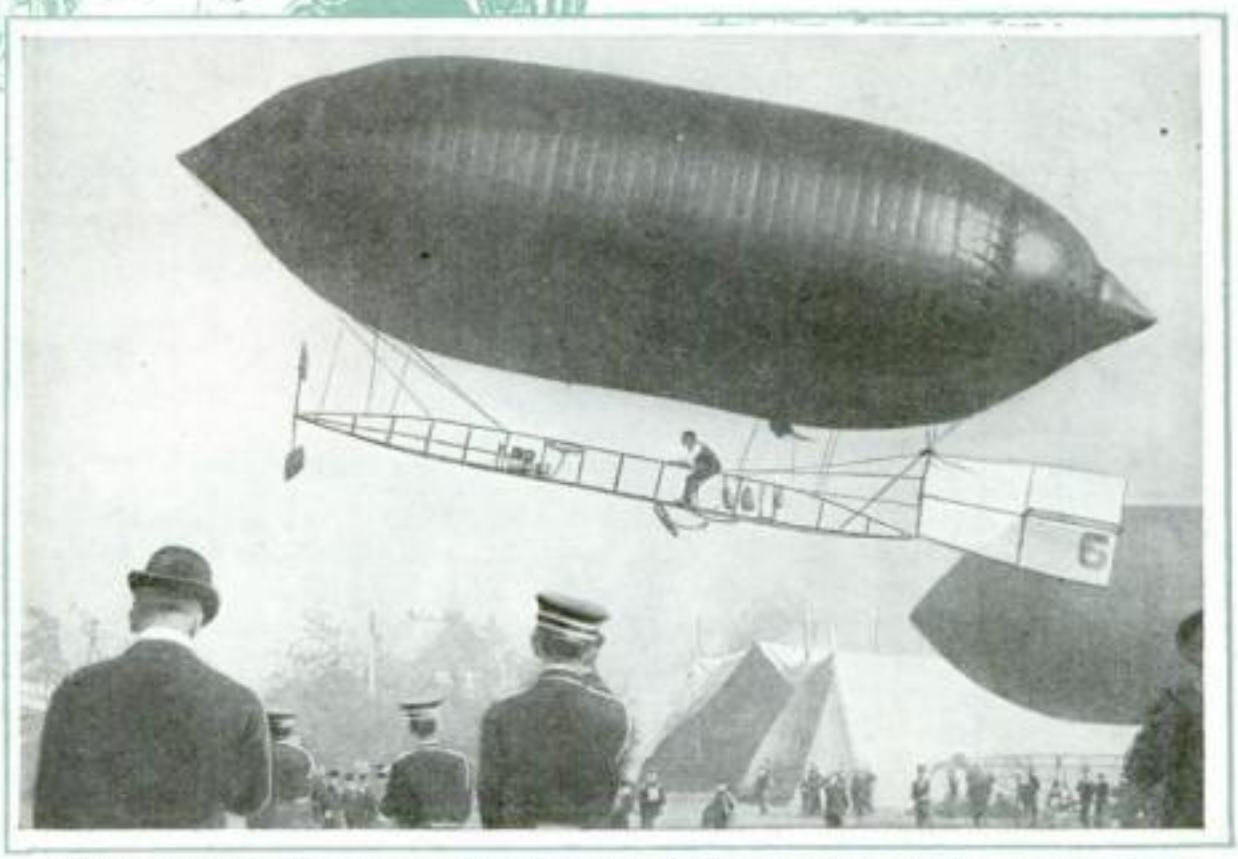
Snapping "props" was a common experience with the pilot of a "rubber cow." These early propellers were made of canvas stretched over frames of Oregon spruce. Half a dozen of these "whirling rags" were always on hand. We also took along at least four spare rudders, folded up like Army cots. The rudder was the last thing over an obstruction, so it frequently got tangled with telephone wires, trees, and roof tops. When one broke off, I shut down the motor and landed. An assistant would unfold one of the collapsed frames, attach it, and off I would go again.

TWO ropes, like reins, turned the rudders. Several times these ropes broke in the air. The most exciting experience I ever had with a disabled rudder was during a flight in a blizzard over Chicago in 1906.

I started from the foot of Chicago Avenue. I had hardly taken off when snow began to fall and the wind rose. The swirling flakes and smoke were so dense that I could barely see the ground from 1,000 feet. The wind was hurrying the big bag over the city in a northeasterly direction. Gusts struck it, rocking the framework.

Over Ohio and Robey Streets, I tried to turn back into the wind. A blast struck the rudder. One of the controlling ropes snapped. The rudder flapped back and forth, useless. Out of control, the big bag swung from side to side like an angry elephant. I cut off the motor and began the battle to land.

I descended to 200 feet and threw out the dragrope. *(Continued on page 142)*



Lincoln Beachey starting race at St. Louis, 1907, which he won, making the circuit in less than five minutes. Notice the bags of ballast hanging from the ship's framework just behind the pilot. In center, the demonstration following Wild's record flight of five hours.

New Inland Canal Rivals Panama

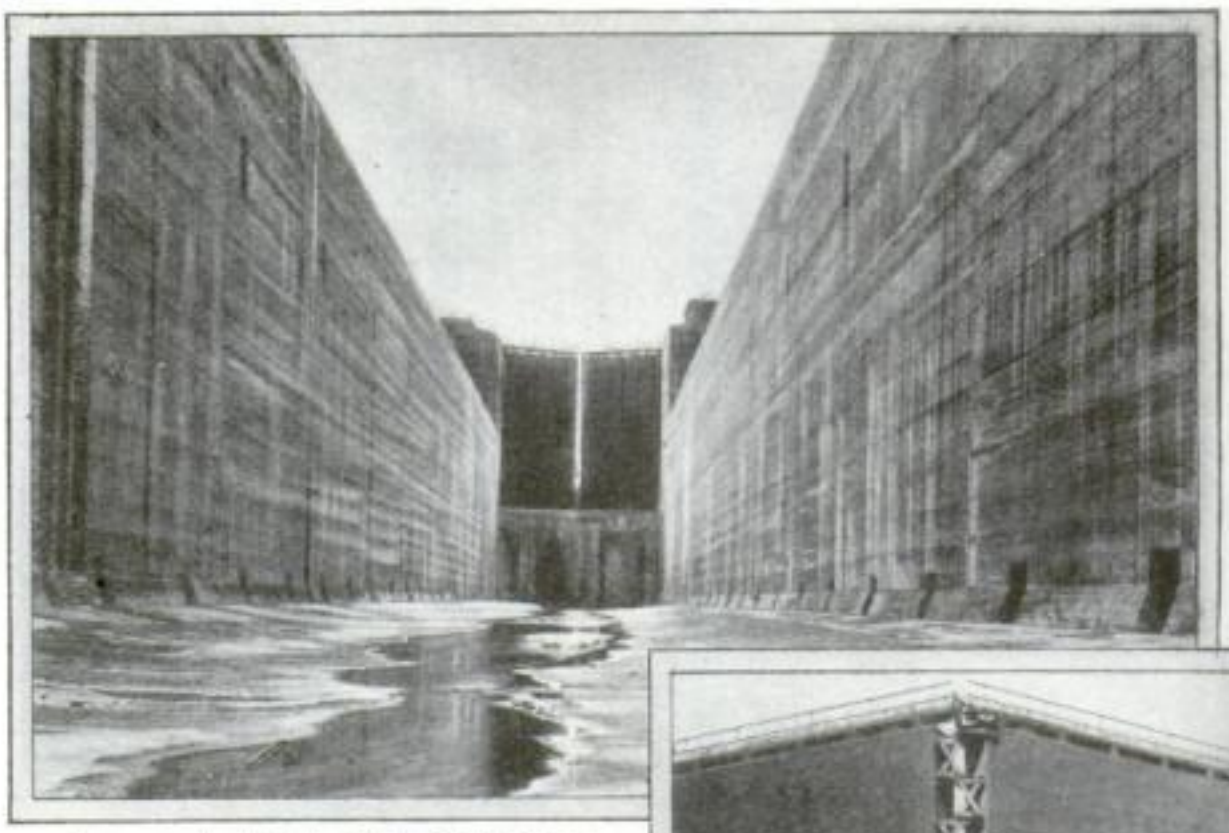
Welland ship waterway made possible by brilliant feats of engineering that are unsurpassed even on Isthmus—Opening soon, it has world's longest lock

RIVALING the Panama Canal, and in many respects surpassing it in magnitude, the Welland Ship Canal, most stupendous canal ever built to join two fresh-water lakes, soon will be open for shipping from Port Weller on Lake Ontario to Port Colborne on Lake Erie, thus providing a deep-water link between these two huge inland seas.

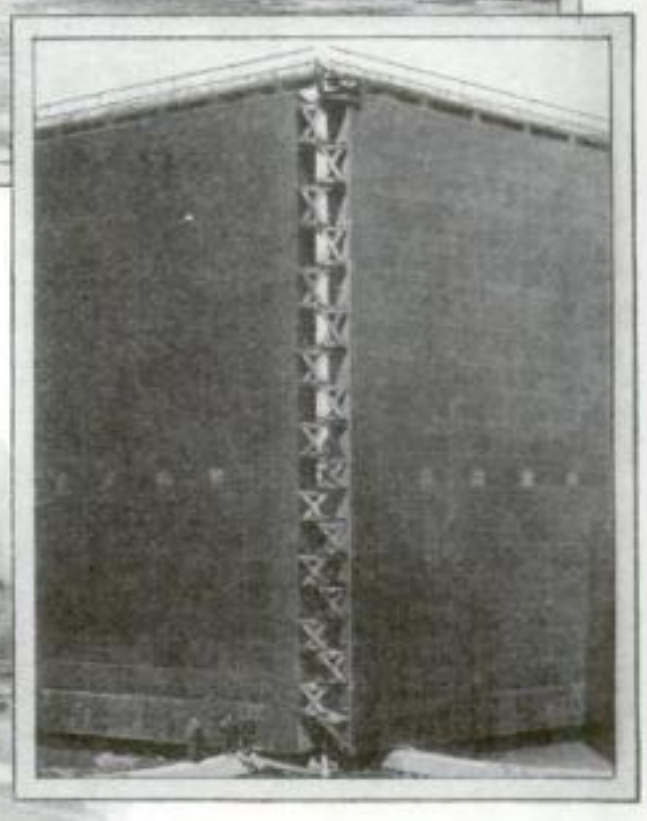
An idea of the proportions of this Canadian engineering project may be gained from the fact that the dirt which had to be dug to construct it is equivalent to the amount that would have to be moved in digging a seven-foot tunnel from New York clear through the earth to China.

The greatest single lift in a lock on the Panama Canal is thirty-one feet. On the new Welland, the single lift is forty-six and a half feet. The total lift on the Panama is eighty-five feet. The total lift on the Welland is 326.5 feet. The longest lock on the Panama is a trifle more than 1,000 feet. One of the locks on the Welland is the longest canal lock in the world, measuring 1,380 feet in length.

Amazing feats of engineering had to be accomplished. A whole river had to be buried in a tunnel seventy-five feet underground at one point and moved out of its course at another to make the canal possible. And all of these jobs had to be done without interrupting the flow of traffic on the old small canal which the new one replaces.



An empty lock in the Welland Ship Canal. The towers in background rise 130 feet.



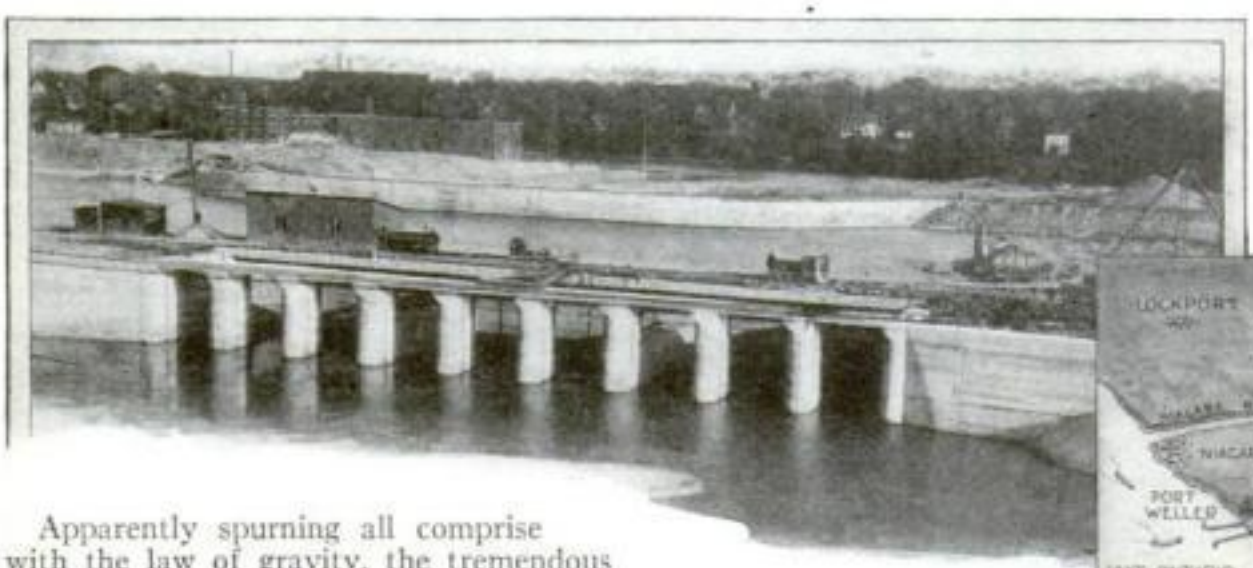
Canal boats in the longest lock in the world. It is the Welland guard lock and is 1,380 feet long. Upper right, huge gates weighing 495 tons each.

walls rise a sheer 130 feet—unbroken perpendicular cliffs of concrete the height of a ten-story building.

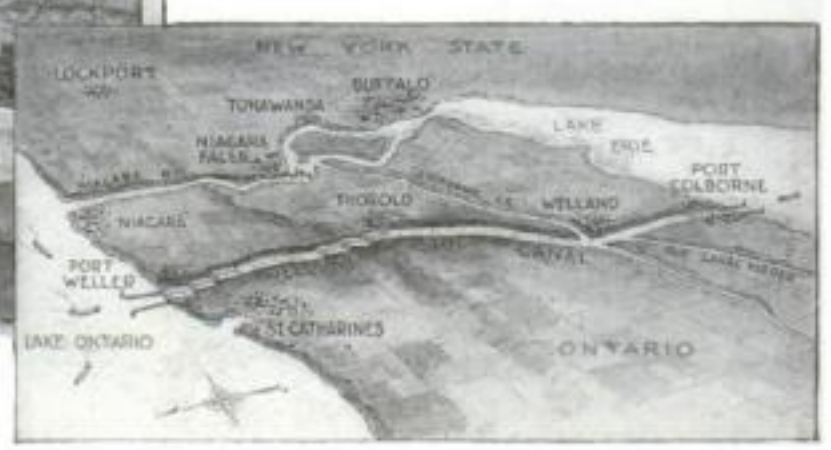
Twenty-five miles long, the canal, in the open reaches, is 310 feet wide at the water line. The locks are eighty feet wide and have a usable length of 820 feet.

Each leaf of the steel gates at the lower end of each of the lift locks is eighty-two feet high, forty-eight feet wide, six feet thick, and weighs 495 tons.

Any of the locks can be filled in eight minutes, which means that they will raise or lower the largest vessel that can squeeze into them at the rate of five and a half feet a minute.



Apparently spurning all comprise with the law of gravity, the tremendous channel marches straight up the Niagara escarpment in a series of steps molded in heroic proportions. At points, its concrete



Above, the Welland River, which now flows under the canal. At right, map of the new canal.

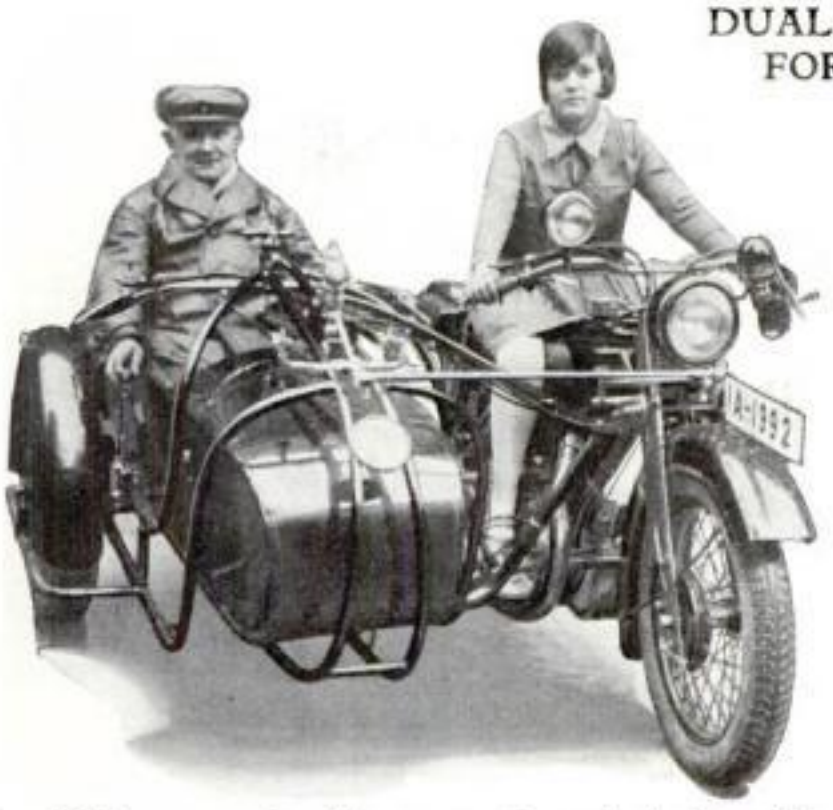
FIRE ENGINE DRAWS LIFE-SAVING BOAT

SEVERAL drownings in near-by ponds and lakes, with no rescue craft available within miles, aroused the inland town of Natick, Mass. So its brush-fire wagon now dashes out on emergency calls, towing on its trailer a twenty-foot rowboat complete with oars, grappling irons, and a lung motor to resuscitate a half-drowned person.

SEND WRITING BY PHONE

GERMAN telephone engineers are experimenting with an attachment by means of which written words may be sent over the line in addition to sound. The listener, using the German device, switches it on whenever he has difficulty in understanding a word. The speaker then spells it out and it appears before the listener in writing.

German long distance lines, it is expected, will be the first to use the attachment. Its inventors say it will popularize long distance telephone use in that country, where the transmission is seldom so good as it is on American long distance lines.



With a motorcycle with two sets of controls, it is possible to teach a beginner to ride with little chance of accident.

DUAL CONTROL CYCLE FOR TYRO RIDERS

IN ORDER that beginners in the sport of motorcycling may safely take driving lessons, a Berlin, Germany, motorist has perfected a dual-control machine.

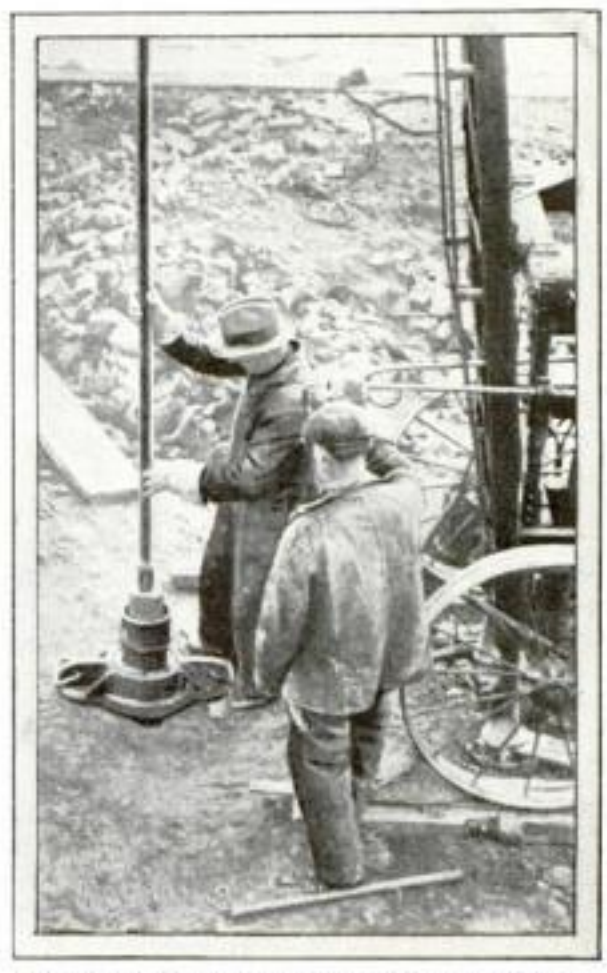
A special side car is fitted with duplicate controls for the motorcycle to which it is attached. Even the steering gear is duplicated, so there is no danger of green students losing control of the machine in an emergency.

This method of instruction has been used in autos and airplanes for some time, but this is believed to be the first instance of its application to the teaching of motorcycling.

TEST CHICAGO SOIL FOR NEW SUBWAY ROUTE

RESIDENTS of Chicago were interested recently to see men going about the city with well-drilling equipment which they set up at various points, sinking holes in the ground and then moving on to the next location. Few of them realized that the men were doing the first preliminary work on the projected Chicago subway. Before excavation starts, engineers must know what kind of earth the tunnels will pass through. In order to find this out, drilling gangs are sent about the city with instructions to bore down to bedrock at various locations.

They use ordinary well-drilling equipment mounted on a portable frame and driven by gasoline motor. Samples of the soil at various depths are taken and studied to see if the tunnels could be driven through them safely and efficiently. The same method is followed before the foundation of large buildings or bridge piers are laid.



These "well drillers" are getting samples of Chicago soil to help engineers on new subway.

ROBOT HANDLES PLANE IN FLIGHT

THE GROTESQUE "mechanical man" in the rear cockpit of this dual-control plane piloted the craft in a recent flight over a Brighton, England, airdrome. His creator, Prof. J. Popjie, in the front seat, took the plane aloft and then turned over the controls to the queer looking robot, who manipulated them in straight flight without a hitch. The "dummy" was a dressed-up version of the latest in automatic controls for aircraft, which can fly the plane on an even keel by means of gyroscopes.

The queer figure in the rear cockpit is a robot, made by Prof. J. Popjie, in front. Recently it guided this English plane safely.

CREWS OF SUBMARINES GET TOAST FOR BREAD

IN CONSIDERING the diet for a submarine crew for a cruise of more than five or six days, naval authorities found that the one article difficult to furnish was bread. After much experiment they have discovered that dry toast is the most satisfactory substitute. Bread is baked ashore and loaves are sliced and dried in slow heat. The slices are then wrapped and packed in cartons protected by a covering of waxed paper.

Fresh bread from the shore will keep only five or six days. It is not baked on board, because when fresh it is indigestible unless the eater is getting plenty of exercise. Officers and men like the dry, or "dehydrated" toast they are getting now, and find it an improvement over bread substitutes previously used.

NAME WANTED FOR NEW "LEMON-GRAPEFRUIT"

WHAT would you call a fruit that has the dimensions of a grapefruit and the color, taste, and appearance of a lemon? Botanists of the University of Washington's pharmacy school are seeking a name for this strange hybrid which they have grown. It is a by-product of their constant search for new plants useful in the manufacture of drugs.

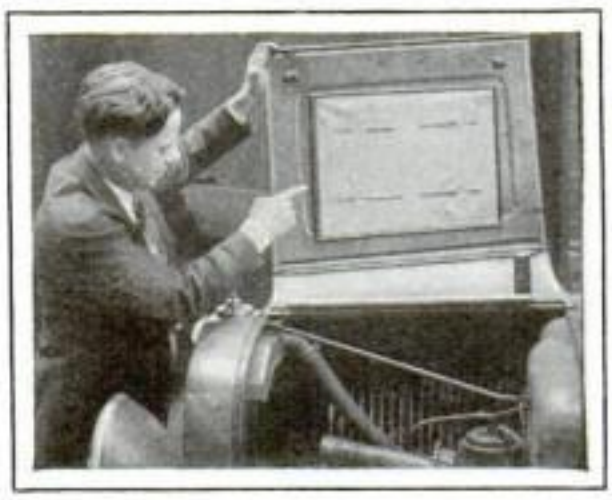
The plant department of the pharmacy school specializes in all sorts of strange horticultural freaks, which have resulted from the experimental work done in cross fertilization and grafting. The "lemon-grapefruit" is a result of one of these experiments, many of which are made in efforts to develop medicinal plants.

BIGGEST "WYE" FEEDS TWO TURBINES

DESIGNED to supply water for two huge turbines, what is said to be the world's biggest "wye," recently constructed at Seattle, Wash., was shipped in parts to the hydroelectric development on the Skagit River. The branch pipes are fifteen feet in diameter and the main pipe is nineteen and one half feet in diameter. The "wye" is thirty-three feet long.

It is made of three-quarter-inch steel plates which are braced with steel angles and bars. Water from the dam divides at the "wye" into two swift-running fifteen-foot streams each of which will run a 95,000-horsepower turbine.

This "wye," biggest in the world, will carry water to turbines at Skagit River power plant.



WEATHER STRIPS KEEP CAR ENGINE WARM

NEW insulation boards shield a car's motor from wintry blasts. They are made of heat-insulating material and are fitted with clips which secure them inside the hood against the ventilation slits, preventing cold air from getting at the engine.

Heat from the motor is thus kept under the hood of the automobile.

LUMBER IN ONE TREE IS ENOUGH FOR 500 HOMES

CLAIMING a world's record for size and age, one specimen of a California Sequoia tree recently observed could furnish timber sufficient for about 500 five-room houses. Its age has been estimated at 4,000 years, and it is still hale and hearty. The Sequoias, world's largest trees, have an average height of about 275 feet, with an average diameter of twenty-five feet.

PLANE WITHOUT WINGS IS SPEEDY ICE BOAT

LOOKING like an airplane without wings, an ice boat built by several St. Joseph, Mo., boys whirls them over frozen lakes at a dizzy pace. Its body, resembling an airplane fuselage, seats two passengers and at the forward end is mounted on old sled runners. A two-cylinder air-cooled motorcycle engine and airplane propeller drive it. The vehicle is steered by swiveling the runner under the rear end of the machine.

BOTH SIDES OF PHONE TALK CAN NOW BE RECORDED

A TELEPHONE with a dictaphone attachment, recently exhibited in Chicago, makes it possible to obtain a permanent record of a conversation. Wax cylinders record the remarks of both parties and may be played back afterward like ordinary dictaphone records. By using this apparatus contracts can be drawn up and legally "signed" over the telephone.

Demonstrating the new machine that records a telephone talk and can reproduce it at will.

HOW CARS KILL

NOT all fatal motor accidents occur while cars are running at reckless speeds, a state bureau of safety recently announced. A six-months' survey showed that many mishaps occur while cars were being moved slowly in backing or parking in crowded places. Out of 1,142 such accidents twenty-six resulted in fatalities.

This home-built ice boat is powered with motorcycle engine, which drives a propeller.

WATER SPRAY IN CHIMNEY CLEANS SMOKE

WASHING smoke and gases from chimneys before they escape into the atmosphere has been accomplished by means of a water-spraying smoke-stack top recently developed. This device resembles a huge dish pan set on top of the chimney. A conical-shaped hood with rings of perforated water pipes inside it creates a curtain of spray falling into the "dish pan." Smoke and gases must pass through the wet curtain to find their way to the outer air.

For larger chimneys where combustion is less nearly perfect, a second curtain of spray is added to insure satisfactory operation. The mechanism does not interfere with the draft, as the cooling spray lowers the temperature of the gases, thus causing a shrinkage, which in turn creates a partial vacuum and thus actually increases the draft. The device, it is claimed, is applicable to all kinds of fuel burners.

Besides removing soot and ashes from chimney gases, the running water carries away tarry vapors and sulphurous fumes, which, although invisible, are injurious to plant and animal life. In tall office buildings, the washer keeps soot from blowing into upper story windows.

Mushroom-shaped device on top of factory chimney takes gas and soot out of smoke. Diagram at left shows how smoke passes through water veil where it is purified before escaping into the air.

BOWED STEEL STRIPS ON CASTERS HOLD CARBOYS

ACID carboys, large glass jars in which chemicals are transported, may be easily handled by a new device. At one end several strips of steel are bent into bows and mounted on four casters. This is rolled under the container and hooked to its wooden casing, after which it may be rolled about plants or factories on the casters, or tipped over on the bowed side of the carrier for emptying. This device also is made in larger sizes for handling barrels of paint and drums of oil.

NEW FISH LINE WEIGHT DISSOLVES IN WATER

A FISHING line weight which dissolves on striking the water solves one of the most difficult problems connected with casting with rod and reel when live minnows are used as bait. It is made of sea sand mixed with a suitable soluble binder, so that it is hard as a rock when dried out. A new weight is used for each cast. The weight is attached by passing the line through the weight's lengthwise groove and bending the small wire seen in the photo around the line.

As soon as it strikes the water it dissolves, allowing the live bait to dart about to the limit of the line. This is impossible with lead weights as they drag the bait to the bottom where it is usually lost among snags and mud. Casting weights weighing as much as six ounces have been used in surf fishing from beaches, permitting the bait to swing with the waves.

203 FOUR-LEAF-CLOVERS FOUND IN FOUR HOURS

SHOWING her keenness of eyesight, Miss Dorothy Schwarze, of Milwaukee, Wis., picked 259 clover stalks, each of which had more than the usual three leaves, in a search lasting four hours, setting what is perhaps a world's record.

In her collection were 203 with four leaves, fifty-four with five leaves, and two with six leaves. Superstition associates good luck with the four-leaf clover, bad luck with five leaves, and death with six.

Proving her keenness of eyes, Dorothy Schwarze set a new four-leaf-clover record.

HOME NO LONGER SAFE, ACCIDENT LIST SHOWS

"SAFE at home" is an expression with little meaning, according to a report on accidents recently issued by an insurance company. It cited the following unusual accidents.

One policy holder lost his front teeth when his baby broke them with a milk bottle. Another swallowed a tack, which he was holding in his mouth, when some one slapped him on the back. A third man swallowed his false teeth while he was asleep. One farmer broke his foot when he kicked a pig.

A hot-water bottle got too full of steam and blew up, scalding another man. One individual broke his hand while he was pounding on his desk. Another man's glass eye broke, cutting his face. Two men suffered broken ribs from being hugged by girls.

Another man was dancing with a girl when one of her hairpins slipped into his ear and pierced his ear drum. A man and his wife noticed their dog about to steal a chicken from their kitchen. They both reached for the dog, the wife with a carving knife in her hand, and the husband lost a finger.

One of the strangest of the home accidents described in the company's records was that of a man who, receiving a sharp electric shock while in his bathtub, fell out of the window.

ASBESTOS SUIT SAVES WORKER FROM ACID

WORKERS in chemical factories or other places where acids, scalding water, or sparks might injure them dress for safety rather than appearance. An asbestos suit to protect acid workers was recently exhibited at an industrial exposition in Belgium. A hooded cape covers the head, the eyes being shielded by thick goggles.

The body of the suit is large enough to cover a man completely from neck to heel, with specially-designed asbestos boots. Large mittens protect his hands, while a loose "shield" of asbestos is draped along his right side. The protective suit is said not to interfere with the user's motions.

Suit of asbestos designed to protect the face, hands, arms, and legs of worker with acids.

NEW VENEER GLUE HOLDS WITHOUT CRACKING

A DRY glue perfected by T. R. Truax, of the United States Forest Products Laboratory, may end troubles now experienced in making plywood or veneers. It is made in sheets, cut to the size of wood panels, laid between them, and held under pressure until it sets. This glue has held wood together even when tested by soaking in water. Its principal ingredients are dried black blood albumen and sugar syrup, the latter being used to retain enough moisture for adhesion after the bulk of water used in mixing it has been evaporated.

Before gluing, veneer is thoroughly dried, but glues now in use contain so much water that it is necessary to dry them after they are glued. This causes checks and cracks to appear in the material, resulting in considerable waste.

TINY DETECTOR REVEALS HEALTH RAY

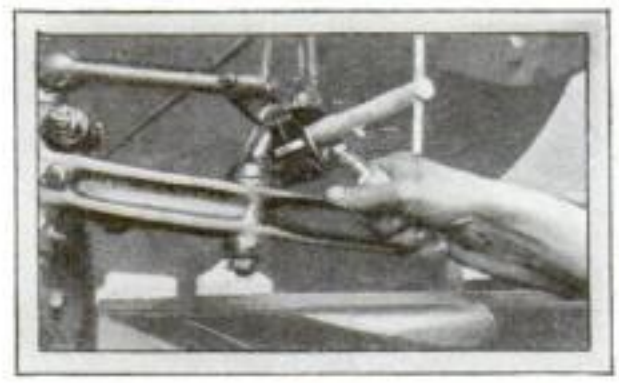
This tiny pocket detector shows instantly whether or not the health-giving ultra-violet rays are coming from your lamp. Above, device being used. Right, detector and case.

WITH the aid of a telltale detector that looks like a pocket microscope anyone can check up for himself whether his health lamp or his special windowpane is supplying him with ultra-violet light.

Even a child can easily use the simple, three-inch device. When it is held in sunlight or in the illumination of a good health lamp, a bright blue glow is seen in the eyepiece, indicating the presence of ultra-violet rays. The fact that ordinary window glass shuts out these invisible rays is demonstrated when a sheet of the glass is held in front of the instrument, causing the blue glow to darken.

The interior of the device, developed by the General Electric Company, is coated with a substance that glows or "fluoresces" when ultra-violet light enters through a slit and strikes it, much as the luminous paint used on watch dials glows under the bombardment of radium or other radioactive material that it contains.

The detector should prove useful to seekers of sun tan by showing the strength of the sun's ultra-violet rays.



SHACKLE LUBRICATOR GETS GREASE HOME

ONE of the most difficult places to lubricate effectively on a car is the spring shackles, and standard fittings are not always built to withstand the pressure which is necessary.

A new lubricator, developed for one popular make of automobile, clamps over the regular fittings. It provides two connections to which a high-pressure grease gun may be applied. Then grease can be forced infallibly into the most inaccessible cranny. With this attachment it is possible to force the grease so thoroughly into the points that are the source of most of the objectionable squeaks, which are apt to destroy the pleasure of a ride, that they are entirely eliminated. The device has been put on the market by an Attleboro, Mass., firm.

MACHINE WRINGS HAY DRY FOR BALING

A MACHINE that squeezes water out of hay while cutting it has proved a benefit to farmers. The motor-driven implement passes the cut crop through rollers, under 2,000 pounds pressure, wringing it dry enough to bale.

This machine literally "makes hay while the sun shines," for by its use it is possible to cut and bale a hay crop on the same day, instead of leaving it lie as cut to dry before putting in its stacks to "cure" as was necessary under the old way before it could be baled. It is claimed that better hay is produced by the new method, which means more vitamins for livestock, less work for the farmer, and a quicker harvesting of his crop.

When hay is cut it is no longer necessary to let it lie on the ground and dry before baling. This machine cuts it and subjects it to such pressure as to wring it dry.

WAR NOW DECLARED ON BOOK BUGS

THE silverfish, a queer insect that eats the covers off books, is being studied by the U. S. Department of Agriculture in an effort to eradicate it. The experiments have shown that the silverfish has a "sweet tooth" for starch. It is the starch in the paste used in making the books that the insect is after when it begins its destructive work.

Strips of cardboard coated with flour-and-water paste, to which is added small amounts of arsenic, are being prepared in the Home Economics Bureau to destroy the insects. They are scattered about the library, attract the silverfish in their search for starch, and kill them.

The silverfish is so called from the silvery glitter of the scales covering it.

At left, the silverfish which destroys books; and above, putting the poison paste on strips.

HOME WEATHERPROOFED WITH AUTOMOBILE TAGS

JEROME K. BARTLETT, of Boise, Idaho, solved the problem of weatherproofing his new home by completely covering it with automobile license plates. As they are coated with durable enamel, it will be many years before his house will need painting.

The builder got the idea for his novel home when he learned that an oversupply of plates was about to be junked by the state authorities at Boise. They gave him permission to cart the plates away.

BIG HOLE IN ATLANTIC AIDS SAILORS IN FOG

DISCOVERY of a new valley in the Atlantic's floor off the New England coast, recently announced by the United States Coast and Geodetic Survey, will help fog-blinded seamen to know their whereabouts. It is two miles wide and eight miles long, sinking 1,800 feet below the normal bottom.

When heavenly bodies are obscured by weather conditions, mariners fix their position on the sea's surface by "dead reckoning." This consists in finding their rate of speed in a known direction from a given point, or finding the depth of water and character of the bottom over which they are sailing. These are found by taking "soundings." When this shows that a ship is over the great submarine valley her exact position will be known.

Above, nailing license plate "shingles" to the wall of a house built entirely of secondhand materials by a Boise, Idaho, man.

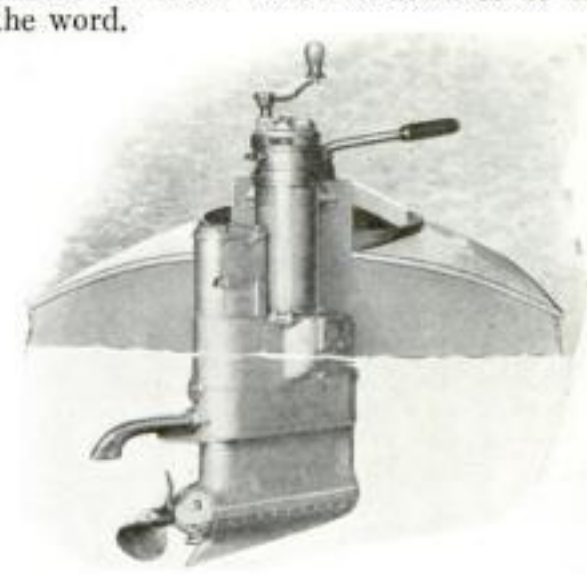
At right, Jerome K. Bartlett, who covered his house with left-over auto license tags.

NEW OUTBOARD MOTOR RUNS UNDER WATER

AN ENGINE that runs under water is the latest novelty for outboard motorboats. Motor, propeller, and rudder are mounted on one shaft, and the boat is steered by turning all three at once.

When designers wanted more space than inboard motors afforded within a boat, they tried putting the motor in the stern and driving the propeller through an L-shaped drive with gears. The new design goes a step farther, and shoves the motor completely out of sight and under water.

The motor is cranked by a handle atop the steering post. The exhaust is under water. Cooling the motor is simple, as its submerged position makes it "water-cooled" in more than the usual sense of the word.



This outboard motor is dropped beneath water line and acts as power and rudder for boat.

DIESEL ENGINES IN INDIA MEET BUS COMPETITION

AMERICAN railways are not the only ones that have had to improve their service and equipment in order to meet the inroads made on their traffic by motor bus competition. From England comes the news that even in far-off India railways are facing the same competitive situation and are taking steps to speed up their service, especially on short runs.

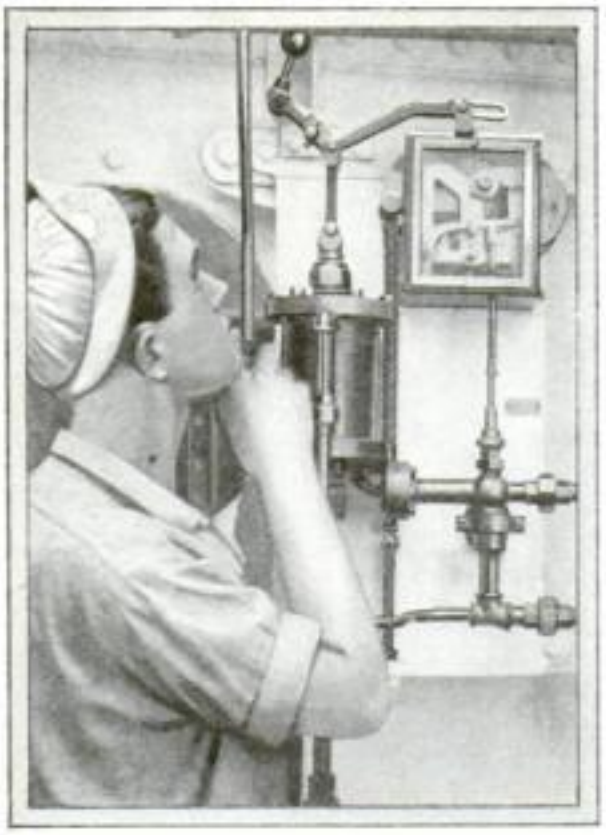
Two Diesel-electric locomotives have recently been built there to the order of the Indian State Railways as a measure for providing cheap, rapid transportation on short hauls on both the main and the branch lines of the North-Western Railway of India.

These locomotives will haul a three-car train weighing 100 tons at a speed of forty-seven miles an hour on a level track. They recently have been loaned to a Scottish railway, which will test them on its own regular runs to see that they are in condition before they are shipped for use on the far-away roads of India.

AMERICA'S HIGHEST AND LOWEST IN CALIFORNIA

WITHIN only eighty-six miles of each other are the highest and lowest points of dry land in the United States, according to the Geological Survey, Department of the Interior. A point in Death Valley, California, is the lowest spot, being two hundred and seventy-six feet below sea level, about the height of a fifteen-story building. Mount Whitney, also in California, is the highest point, 14,496 feet above sea level, nearly three miles high.

Strange Life of a Big Ship That Never Goes Anywhere



Designed to be heard above the roar of Atlantic gales, the giant siren, seen below, sounds a code so seamen can identify *Lightship No. 114*, anchored off Fire Island. Above is seen the mechanism that works a valve admitting compressed air to sound the siren.

LIGHTSHIP NO. 114, recently placed on the Fire Island station to guide the enormous amount of shipping coming into New York harbor, represents the latest word in the construction of this type of vessel. She is a far cry from *Lightship No. 1*, the first on the American seaboard, which had no machinery, comparatively feeble oil lights, and made fog signals by gunfire.

Lightships are floating lighthouses placed along the coast at points where shoals extend so far offshore that they constitute a menace to shipping. They remain at anchor in exposed positions regardless of weather, their crews continually subjected to the discomfort of a vessel at anchor in a heavy sea.

On her stumpy masts, *Lightship No. 114* carries two 18,000-candlepower lights. They are operated automatically and on a clear night can be seen for thirty miles. A weird-looking compressed air siren, known as a "diaphone," makes sound signals that can be heard above the wildest Atlantic gales.

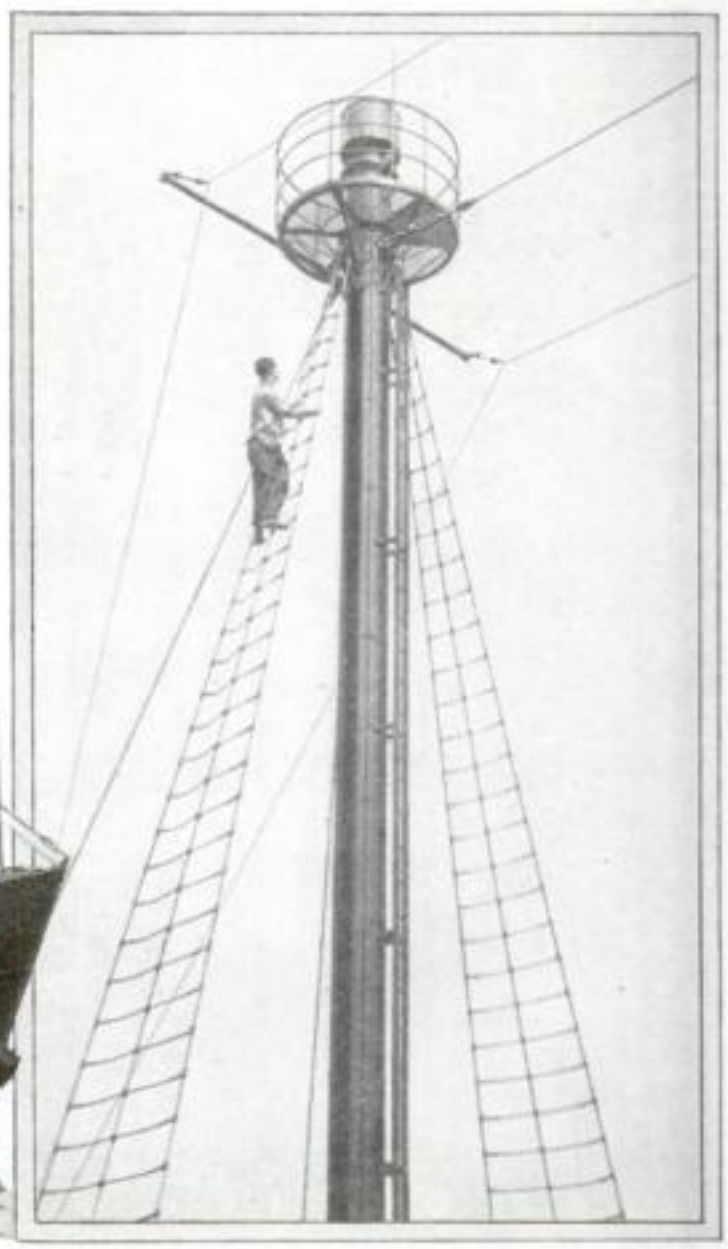
Ships out of range of *No. 114's* sound and light signals may be guided to her by the radio direction finder. Electricity for this, the big beacons, lights, and refrigeration is supplied by four Diesel-driven generators, which also furnish motive power for the ship.

Lightship crews are given unusually comfortable quarters. Spring mattresses and heavily upholstered cushions add to the well-being of *No. 114's* men. They have fresh meats and vegetables to eat at all times.

No. 114 had the unique experience, for a lightship, of a 6,000-mile ocean voyage from her builder's yard in Portland, Ore., to her station off New York harbor. It is expected she will have a longer term of duty than the vessel she relieved—thirty-three years. So, for close on to the next fifty years, *Lightship No. 114* will roll and tug at her huge anchors—a ship that never goes anywhere.

Mushroom anchors, like the one seen above at the bow of the lightship, hold the vessel to the exact spot selected for her. In spite of the fact that anchors and chains are far heavier than those ordinarily used, it is sometimes necessary to use the engines, of the Diesel type, to relieve the tension on them.

The new lightship, built to withstand the constant buffeting of ocean winds and waves, guards the shoals outside New York's harbor. She may remain at anchor for fifty years. Notice the compressed air siren, known as a "diaphone," just aft of the vessel's stack.



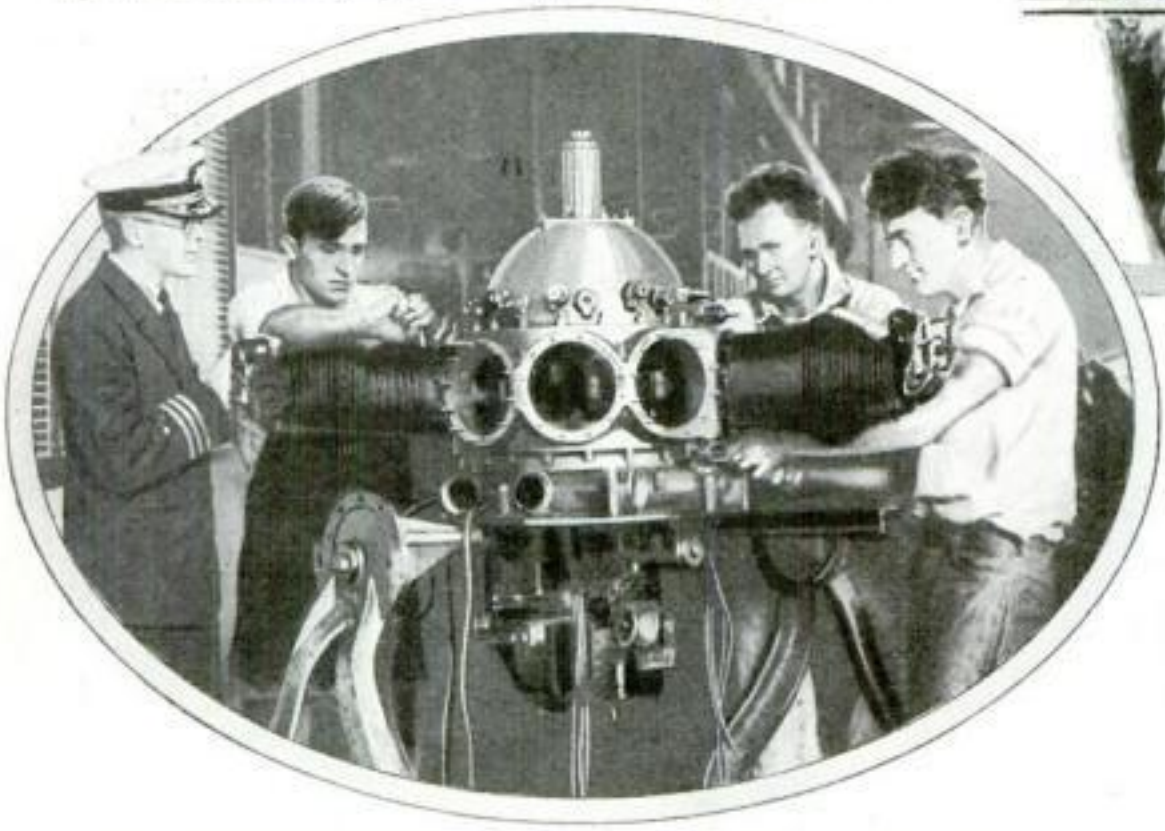
On her stumpy masts, *Lightship No. 114* carries two 18,000-candlepower beacons. One is shown above. On clear nights they can be seen for thirty miles.

Keeping 400 Navy Airplanes Ready to Fly

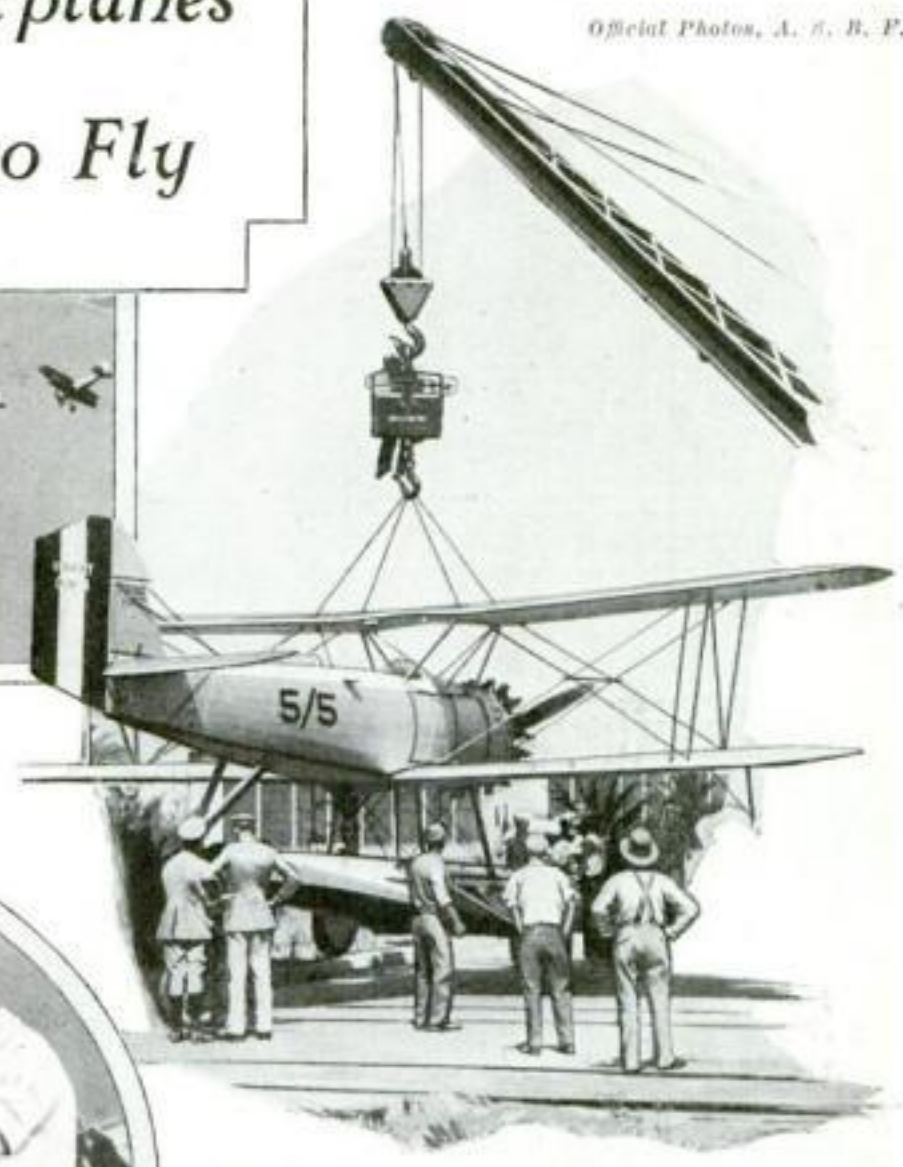
IT TAKES more than a pilot to keep a plane in the air, as these photos show. They illustrate how mechanics rebuild annually 400 fighting, bombing, and torpedo aircraft of the North Island Naval Air Station, San Diego, Calif., after each has flown about 30,000 miles.

Official Photos, A. & B. P.

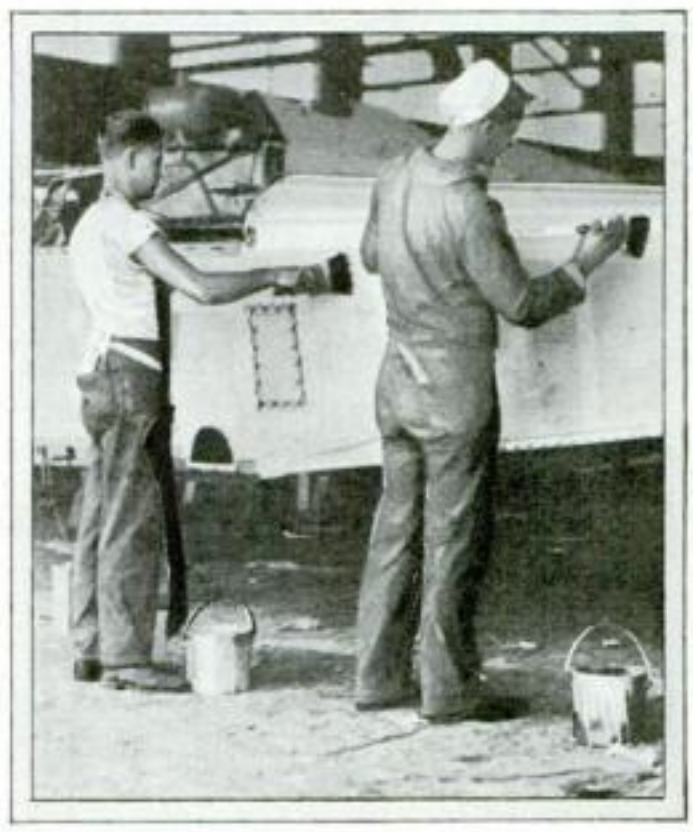
INTO THE AIR AGAIN. A few of the Navy's fighting planes, after they have been thoroughly overhauled, pass by in parade formation.



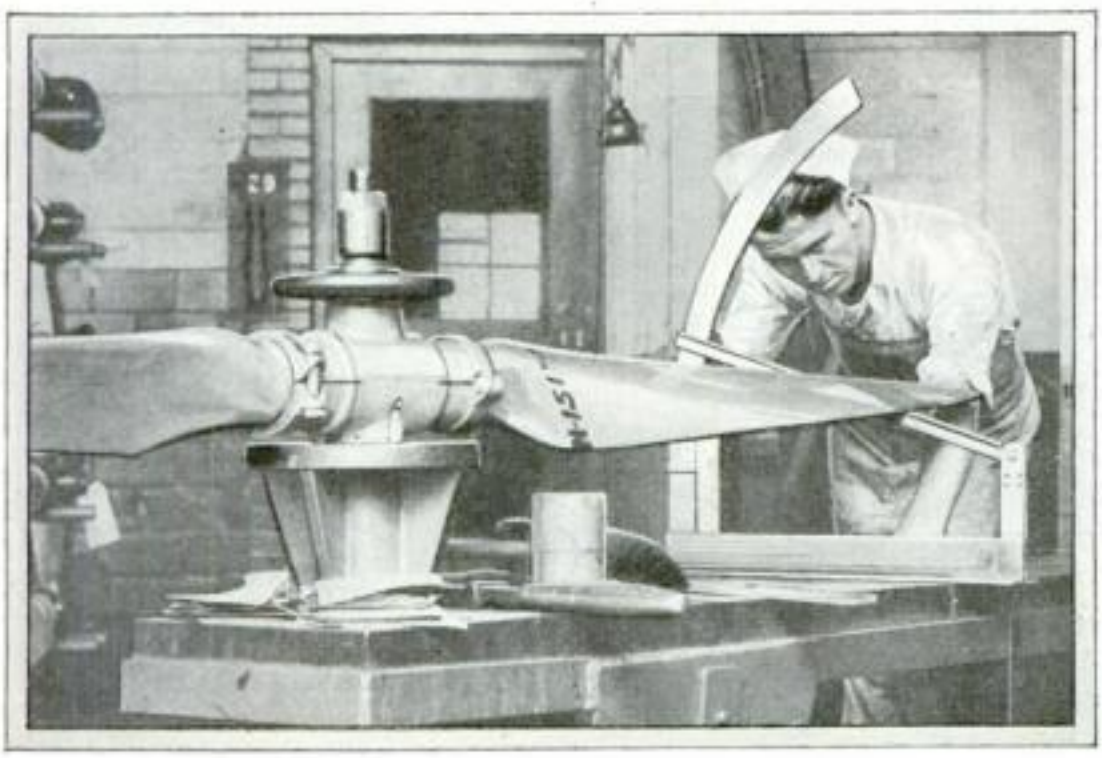
MISTAKES MEAN WRECKS. Rebuilt engines for Navy planes are put together with exactness. Above, assembling cylinders and pistons.



HAS IT GAINED OR LOST? After the mechanics, who rebuild 400 planes each year, are through with a plane, it is weighed as a final test.



FINISHING UP THE FUSELAGE. When a plane comes into the shop the fuselage is sandblasted down to clean metal and every welding is examined. When all fittings are perfect, a new covering is put on and dope is applied, as above, to tighten and preserve it.



ABSOLUTE PRECISION NEEDED. After a propeller has been taken apart, completely refitted, and then assembled, the matter of balance and angle must be attended to. The blades are balanced to hair's breadth and set at required angle. At the left, a machinist is testing a blade.

TRACTOR CYCLE FOR ROUGH GROUND

WITNESSES of the Fascist militia's recent maneuvers near Rome, Italy, saw a rider on a motorcycle of novel design leave the road, scoot across rough fields, and scud up the side of a hill dotted with boulders. The occasion was a test of the latest vehicle for dispatch riders.

Instead of a rear wheel, the queer motorcycle is driven by an endless tread like that of a tractor. Cleats on the tread give firm traction regardless of the character of the ground. The tractor drive is so pivoted that it can tilt forward or to the rear, accommodating itself to uneven terrain. Power reaches it through a chain drive. A heavily-braced, triangular frame supports the tractor at a point far enough back of the seat so that its gyrations will not bump the driver.

While designed primarily for military use, the "tractor motorcycle" may prove to be a useful aid to campers, surveyors, and others whose work or recreation takes them off the beaten track and over rough country. In the cover design for this issue, our artist depicts it climbing a rocky slope. The box at the rear, mounted upon a rudimentary mudguard, carries supplies or dispatches according to the use to which the vehicle is being put.

Italian militia are trying out this motorcycle with a "war tank" drive as means of travel over rough ground. Tney find it superior to horses now generally used.

HAND PAINTED FIGURES NOW DECORATE AUTOS

PAINTING automobile bodies with pictures representing their owner's favorite pastimes is the original idea recently introduced by Miss Helen Doherty, daughter of a New York utilities executive and financier.

On one of the cars which she painted for a fox-hunting enthusiast, front and rear mudguards form natural obstacles over which figures of riders and horses seem to be leaping. The artist has decorated a number of machines in this manner as presents for her friends. Her work is autographed.

It is likely that the desire for hand-painted cars will spread, but as only a trained and skillful artist can do the work, it is probable that the fashion will not reach the proportions of a fad.

SALMON EGG DIET PUTS FIGHT IN BROOK TROUT

FIGHTING trout, of beautiful coloring, are now being raised in Government fish hatcheries as the result of experiments with a new fish food lately conducted by Dr. Herbert S. Davis, of the United States Bureau of Fisheries. He discovered that gameness and coloring of fish were greatly improved after feeding for three weeks on a diet consisting in part of salmon eggs. Formerly fishermen objected to hatchery-bred fish on the ground that they were not lively enough to give them a good fight and that their coloring was dull and lifeless, detracting from their appearance when stuffed and hung on the wall.

Salmon eggs at present are useful only as a substitute for sturgeon eggs in caviar. Experiments are now being conducted to see if the coloring of goldfish can be heightened by putting the household pets on a diet to which dried and ground salmon eggs have been added.

Above, how the dried and ground salmon eggs appear before they are mixed with chopped meat for feeding to fingerlings. At right, Dr. Herbert S. Davis, of the Bureau of Fisheries, feeding salmon eggs to trout.

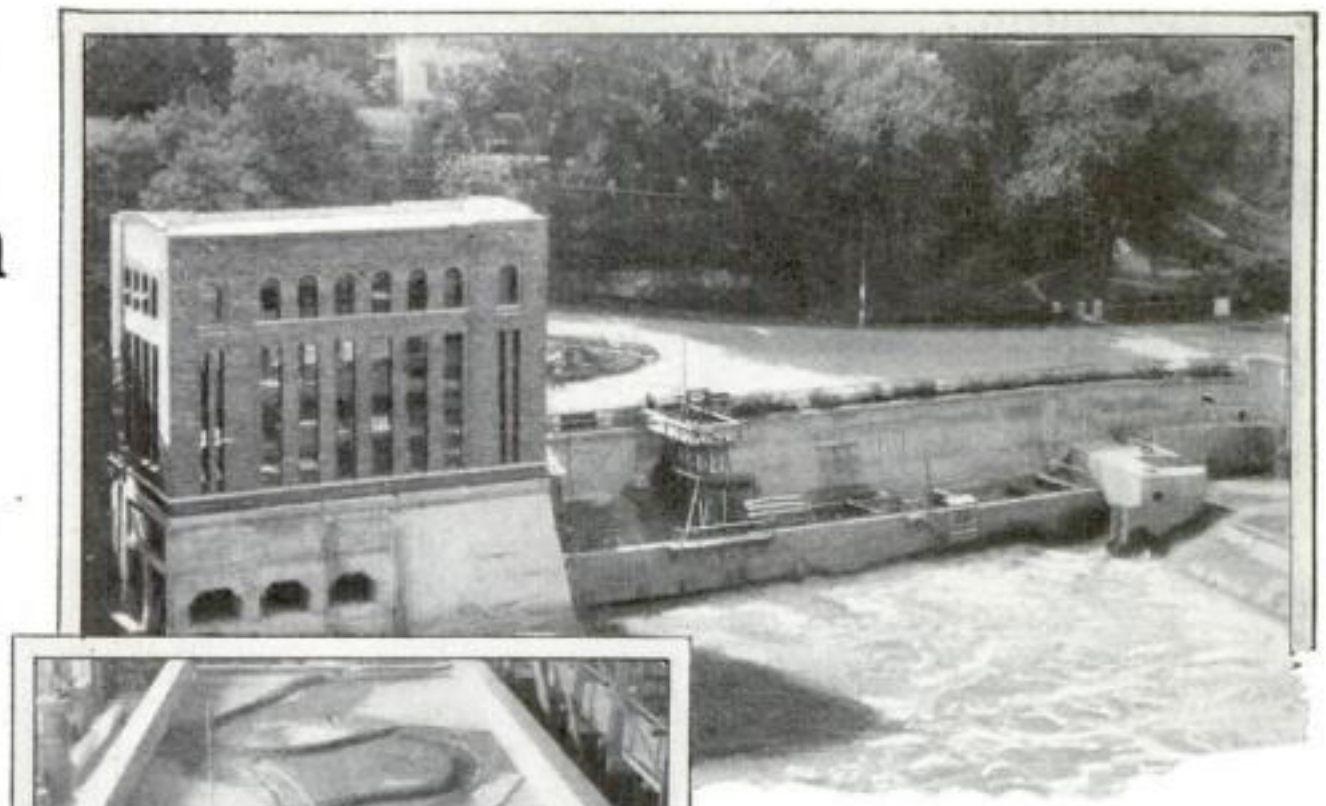
Rivers Built in Strange Laboratory

ENGINEERS at the University of Iowa are studying flood control in a four-story hydraulic laboratory, where scale working models of rivers are constructed so that they may be observed under the closest possible approximation of conditions in the actual streams.

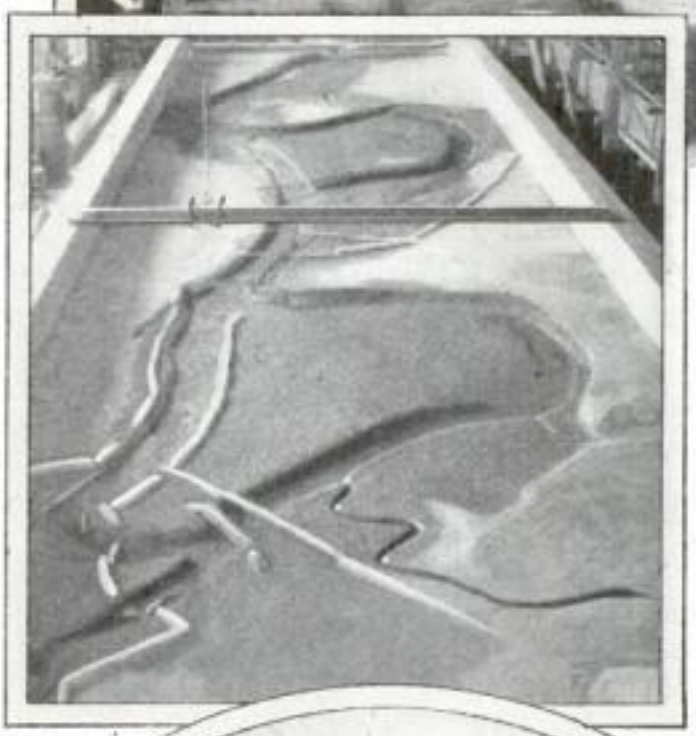
A ten-by-fifteen-foot canal 190 feet long carries river water from a nearby dam at Iowa City to the laboratory basement. From there it is pumped to the top floor, where a constant-level tank maintains an even flow of water to all parts of the building in which tests are being conducted. Large-size river models are constructed on this floor in a ten-by-forty-three-foot trough. It is mounted on jacks so actual slopes of river beds can be obtained.

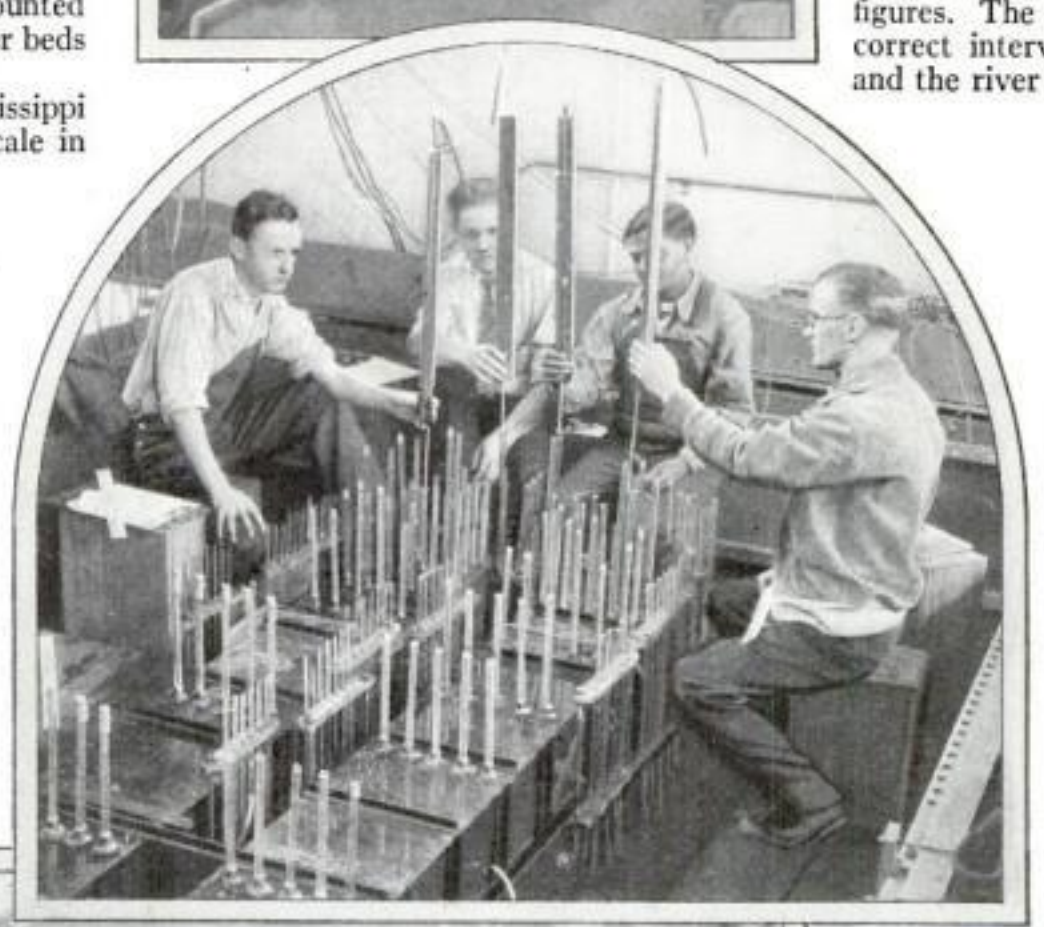
Twenty miles of the Mississippi River were recently built to scale in the laboratory, showing the stream between Hastings and St. Paul in Minnesota. The object was to determine what effect the river would have on a dam being planned at Hastings, which is designed to maintain a constant level in the river above that point.

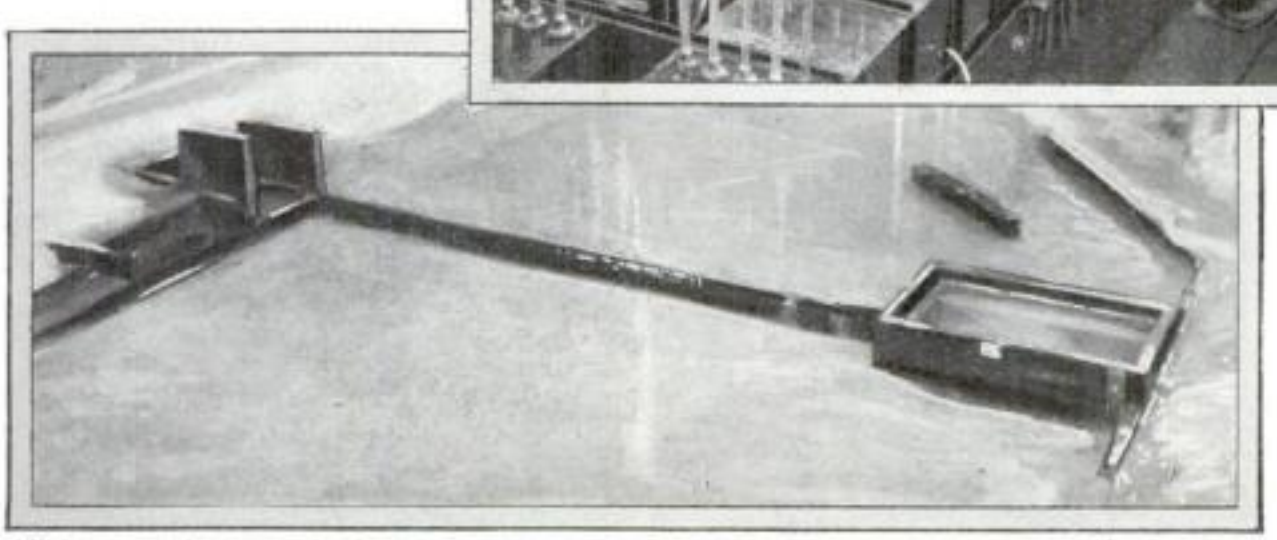
In order to do this it will have gates that permit surplus flood water to flow past the dam from above. But the Mississippi does not like gates in its path, and when its current is forced through their narrow openings it scours out the bottom at those points. These conditions cannot be calculated by mathematical formula, but observation of water running through actual gates in the model showed engineers how to build their dam to withstand the scouring action of the river's current.



Above, hydraulic laboratory at University of Iowa and, left, model of Des Moines River.







Using a ten-inch model channel, an effort is being made in the center picture to determine, by means of Pitot tubes, the velocity of spread in an eighteen-degree bend. Directly above is a small scale model of the dam at Gray's Mills, showing the power plants around which sediment collects.

In constructing these models, every detail of the real river is studied and reproduced to scale. Depths of water on straight lines across the stream are measured at frequent intervals. Strips of tin are then cut to contours shown by these figures. The strips are placed upright at correct intervals along the model trough and the river bed is modeled to their high and low points.

Where cement is used to represent river bottoms, it is riffled to imitate the effect of currents on soft ground. Sand and gravel are used at points where the current is rapid, to show how much the river will dig out its bottom in a given time.

After working models of the river have been used for several hours, water is drained off and the bottom laid bare for study. By this means several efficient methods of flood control have been devised. In one instance engineers not only reproduced the river bed, but they made a working model of an entire flood!

Other parts of the building are used for studying the effect of bridge piers, railway trestles, and piling on river currents. These also cause a scouring effect on the bottom when placed in swift currents, sometimes with disastrous results to themselves. This can be avoided by study of models that show the best manner of placing foundations for such structures.

Models of river beds have for several years been studied in foreign hydraulic laboratories, at Cornell University, Ithaca, N. Y., and at Worcester Polytechnic Institute, Massachusetts. The one at Iowa City is believed to be one of the largest in which river beds have been studied.

POCKETS IN NEW ALBUM HOLD PHOTOGRAPHS

SOMETHING new in the line of photograph albums was recently placed on the market by a New York firm. It is designed on much the same principle as a large pocketbook. Pictures are held in pockets, which vary in size to accommodate different-sized photos.

It is not necessary to paste them in, and they may be removed and passed about for examination. The simplicity of inserting the photographs insures that they will be put in place as soon as they come from the finisher, lessening the chance of loss.

NEW PROCESS EXTRACTS RUBBER FROM MILKWEED

PROVING that rubber can be made from milkweed, Arthur E. Bergquist, of Lindstrom, Minn., amateur research worker, built a model apparatus with which he has made small quantities of rubber. A tall odd-shaped chimney carries a tank and wide-surfaced wheel at its top, the tank being filled with milkweed sap. Heat from a birch bark fire heats tank and wheel.

When these are thoroughly heated the sap is allowed to flow onto the wheel while it is slowly rotated. Solid matter sticks to the wheel, but liquids drop off into the chimney. The solids left on the wheel are raw rubber that is elastic and is said to compare favorably with the best rubber from plantations in Para and India.

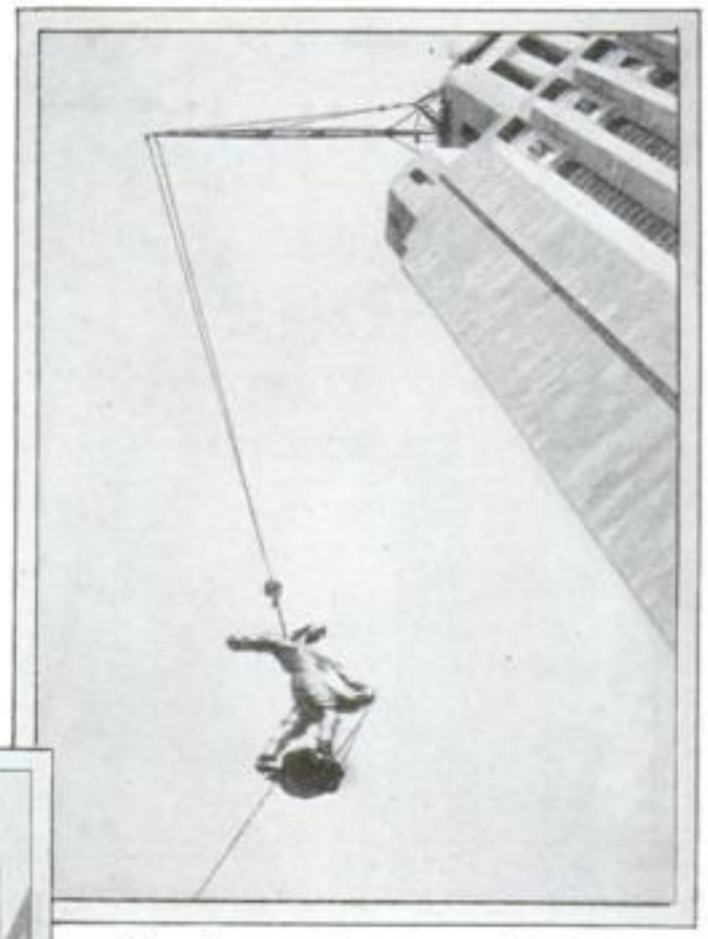
With a machine he invented, Arthur E. Bergquist, of Lindstrom, Minn., has succeeded in extracting rubber from the lowly milkweed, a sample of which is shown at the right. The hot sap leaves its rubber on the wheel at top of machine illustrated above.

TEN-TON STATUE IS RAISED 400 FEET

RIGGERS on the new state capitol building at Lincoln, Nebr., raised a ten-ton statue the other day from street level to the tower top, a distance of 400 feet. The huge bronze figure on its airy perch represents a wheat sower of Biblical times, but onlookers and workmen christened it "Bozo." Twelve picked men were chosen for the task of giving Bozo his dizzy ride and putting him in position on the tower.

His ride took but twelve minutes, and there was no hitch in the proceedings. The hoisting engine that raised him was located so its driver could not see any of the operations, but he performed his share in the task successfully by receiving his orders over a telephone—bell signals not permitting such positive control of the hoist as instructions by the human voice. An ordinary telephone headset was clamped over his ears during the lifting of the statue to its place.

This ten-ton statue of a symbolic wheat sower is seen hooked to tackle for 400-foot ride.



From the ground to the top of the Nebraska state capitol the statue was raised safely.

LOUDSPEAKER IN CAR WARNS PEDESTRIANS

A BRITISH motor car has just appeared that has no horn, but is fitted with a loudspeaker instead. A microphone, attached to the steering wheel, is connected to a dynamic speaker under the hood. By using this device the driver can warn pedestrians, telling them what he is about to do, or notify drivers of other machines when he is about to turn or stop.

This is believed to be the first instance of the use of a loudspeaker in a private car. Machines have been so equipped for the purpose of making public announcements, but hitherto they have not been used as a means of warning pedestrians.

As shown below, the microphone is strapped to the steering wheel at a height convenient to the driver's mouth.

A microphone on wheel and a loudspeaker under hood enables driver to shout warnings.

GOVERNMENT DEVELOPS GIANT SUGAR CANE

A NEW sugar cane that yields three bags of sugar where the best commercial varieties produce but two, has now been made available to planters by the United States Department of Agriculture. In addition to giving more sugar this plant is highly resistant to mosaic disease, which did much damage to Louisiana cane fields before it was checked by plants brought from Java.

For the last three years experimental fields at Canal Point, in the Florida Everglades, have produced nearly three tons of sugar an acre, double the average yield.

NEW AUTO TOY GIVES CHILD CHANCE TO DRIVE

SO THAT children may "drive" when they go automobiling with their parents, a new toy has recently been placed on the market. A U-shaped tube, one end attached to the child carries a small steering wheel on its other end. With this the child can turn the wheel and toot a horn.

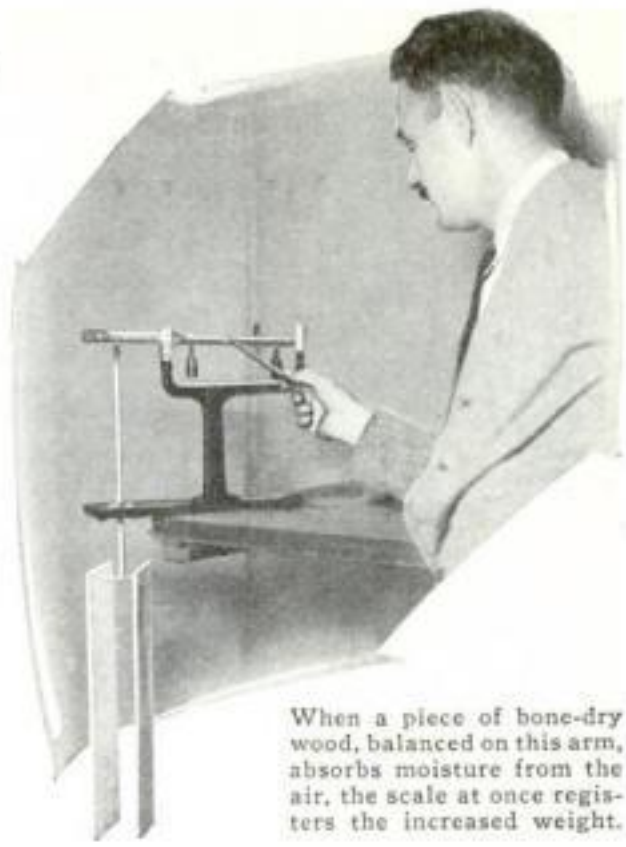
Wheel and horn attached to child give him the thrill of driving while riding in auto.

"PINHOLE" IN METAL MAY HARBOR MANY GERMS

METAL parts of machines such as fruit juice extracters and soda fountain equipment must have an absolutely smooth surface and be free from "pinholes," or tiny imperfections in castings and welds. Users of this machinery have found that one such pinhole may house millions of germs. Consequently, one maker gives his welders efficiency tests. A man who makes only one pinhole in a weld scores ninety percent, and none at all counts 100 percent.

BOOSTS V-SHAPED BED AS BETTER FOR REST

AN UNUSUAL looking bed insures better rest and relaxation, according to its inventor, Joseph H. Pilates, former physical director of the German police force. It is made in two sections, in the shape of a "V." This shape, Pilates says, supports the body perfectly at every point, no matter what position the sleeper may assume. A lever raises the bed to the conventional horizontal position whenever desired. Models have been designed for household, beach, and camping use. Pilates plans to manufacture the bed in this country.



When a piece of bone-dry wood, balanced on this arm, absorbs moisture from the air, the scale at once registers the increased weight.

BALANCE IN SHOP TELLS MOISTURE IN LUMBER

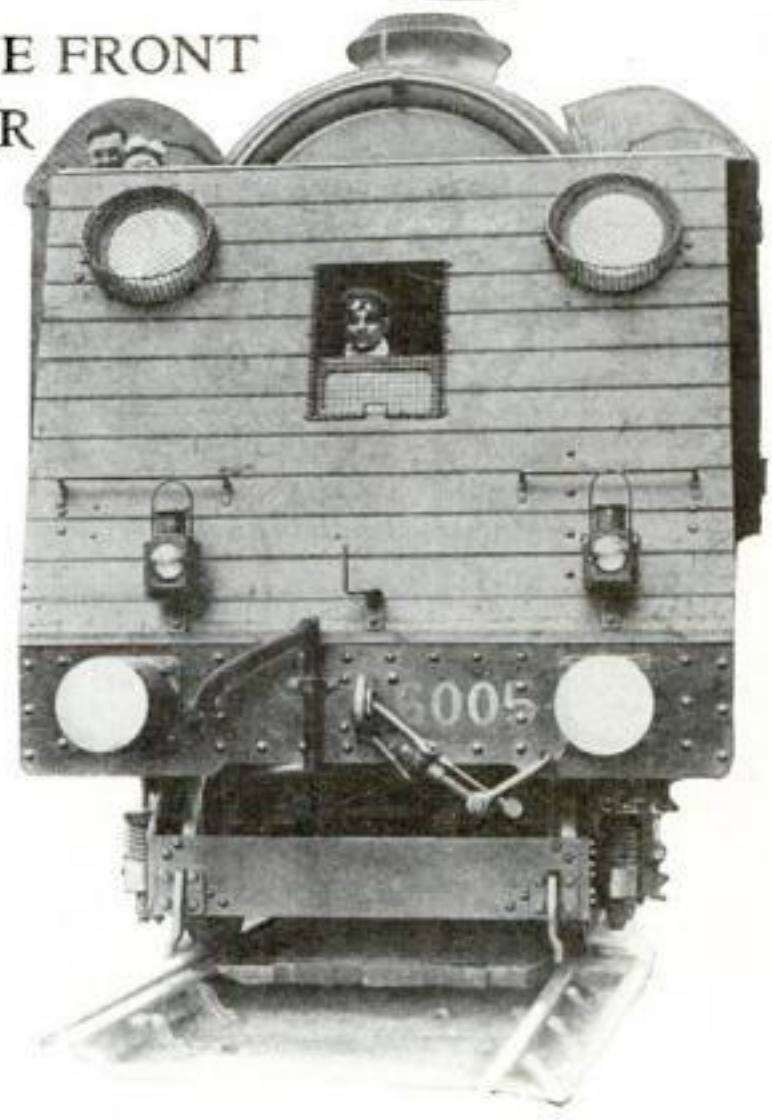
Now a woodworker can tell by the condition of the air in his shop how moist or dry his material is. A balance developed by the U. S. Forest Products Laboratory weighs the amount of moisture that the wood is likely to pick up from the air, just as if it were so many pounds of peas on a grocer's scale.

A standard piece of wood, hung on one arm of the balance, is cut to weigh when bone-dry exactly one hundred units of any convenient quantity. Therefore, when the air is dry the balance swings perfectly. But if six units, say, must be added to the weights to maintain balance, the sample is known to have absorbed six percent of its weight of moisture from the air.

MEN RIDE ENGINE FRONT TO STUDY POWER

How much horsepower does a locomotive develop under actual operating conditions out on the road, drawing a heavy train? This is the question that men behind this odd-looking shield on the front of a British passenger locomotive are seeking to answer. While the engine is speeding over its run they will make "pictures" of the work done by steam in its cylinders, using for the purpose a little instrument known as an "indicator."

It is mounted on top of the locomotive's cylinder, steam from which enters it through a connecting pipe. In response to the fluctuation of steam pressure in the engine's cylinder, the indicator charts a record on a paper card. This is taken back to the railway offices and analyzed, the results often enabling engineers to make adjustments in an engine's mechanism that materially improve its efficiency.



An observation box on the front of English locomotive aids in getting data as to actual horse-power.

At top, engine wheels being lowered for repair; above, the wheels seen in elevator.

LOCOMOTIVE WHEELS DROP OFF IN REPAIR SHOP

TAKING a pair of wheels off a locomotive sounds like a major operation, but it is simple with modern equipment. The newest wrinkle is an electric elevator built into the floor of the repair shop. Its top forms a part of a length of track upon which the locomotive rests.

When a locomotive is brought in to have its drivers repaired, the wheels are centered on the elevator and disconnected. There is a hum of motors, and the wheels gently descend out of sight into a pit, as shown in the photograph above.

Then the whole elevator shifts sideways on a subterranean pair of rails, the motors are reversed, and the locomotive wheels reappear on the same level as the engine. They may be rolled away then over the shop floor into the repair room. The husky electric elevator, recently developed by a Muskegon, Mich., firm, can handle loads up to fifty tons.

NEW LAMP REFLECTOR IMITATES DAYLIGHT

A NEW reflector that can be slipped onto any lamp adds to lighting comfort by imitating daylight. Its blue-glass mirrors distribute a soft white light, said to be easier on the eyes than the glare of ordinary bulbs and pleasanter to read by, as it filters out the bulb's yellow rays.

A spring holder quickly and easily fastens the reflector to a bulb, no screws or other devices being required. Unsilvered transparent rings of glass in the reflector allow the light to shine sideways through the shade of a lamp, as well as downward, for reading. Fifty- or sixty-watt lamps are said to work best with this "daylight" device. The reflector, designed especially for use with a bridge or reading lamp, may be used to advantage on ceiling or wall lights as well.

This reflector for reading lamp has blue-glass mirrors to distribute the light, filter out yellow rays, and give an imitation daylight for reading.

GREAT HIGHWAY BRIDGE SPEED DEMON'S DELIGHT

TRAFFIC officers have no difficulty in enforcing the forty-mile-an-hour minimum speed limit on the James River bridge connecting Newport News and Norfolk, Va. This makes the four-and-a-half-mile concrete span one place where motorists can step on it to their hearts' content. While there is a speed below which you are not allowed to drive over this bridge, you can go as much faster as you care to or your car will go. The new ruling is said to have speeded up traffic satisfactorily on this link in the southern highway system, which is one of the longest highway bridges.

The photograph at the right shows traffic officer E. Hogue, stationed on the bridge, telling a puzzled motorist to "step on it" to avoid congestion.

On one of world's longest auto bridges, crossing James River, Virginia, drivers are told to go forty miles an hour—or faster.

NEW ENGINES USE OLD TWO-PRESSURE BOILER

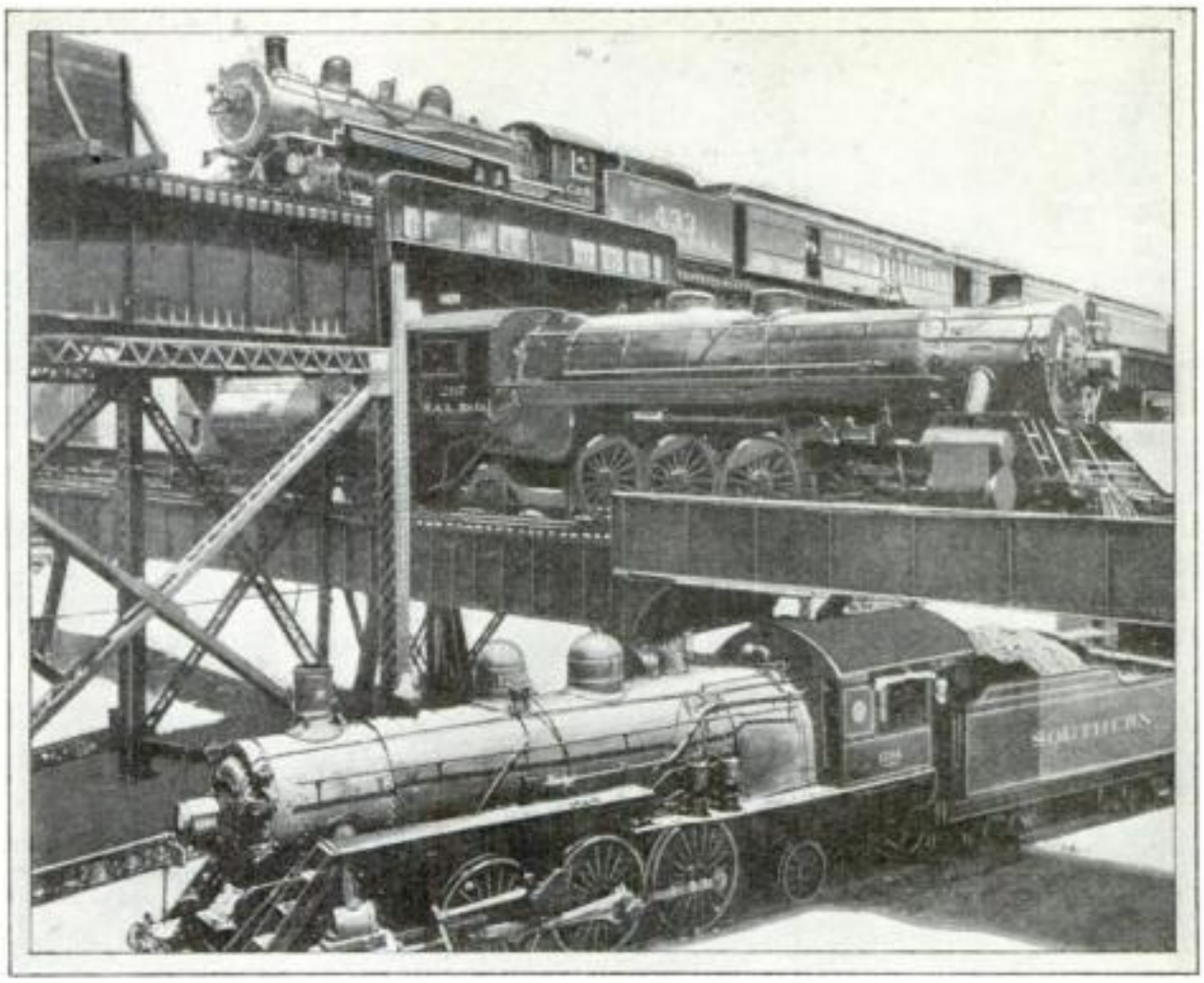
GERMAN railway engineers have found that the principle of the "two-pressure" boiler, developed by Jacob Perkins, an American engineer, in 1832, can be applied to modern locomotives with great efficiency as a result. Experimental engines built in this way have, they claim, hauled trains at lower cost than is possible with the most modern central station electric power generating system.

The water tube boiler, which consists of a small upper cylindrical portion connected to pipes that line the fire box, produces steam at 1,800 pounds pressure after the steam has passed through superheaters also located in the fire box. This steam supplies two high-pressure cylinders and then exhausts into the second boiler, which is of the ordinary fire tube type. Steam from this boiler operates a low-pressure cylinder of much larger diameter. Thus more of the heat developed by the burning coal is turned into usable power.

MINE MULE NOW WEARS HEADLIGHT ON COLLAR

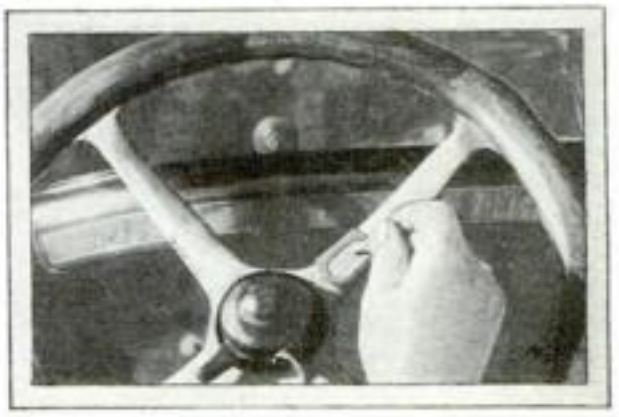
MULES wear headlights, just as miners do, in a Pottsville, Pa., coal mine. An electric flashlamp, suspended from the collar of the animal's harness, enables it to see its way when it plods through a dark underground shaft towing a coal car. The mules show their appreciation by the increased efficiency of their work. This is only one indication of the sweeping changes that the use of the electric light has brought to the mines of the world. It is a far cry from the safety lamp invented by Humphry Davy and Michael Faraday, a century ago, to the brilliant headlight now worn by a mule in a mine, every part of which can be thoroughly lighted with little danger of fire or explosion.

No longer groping in darkness, the mine mule now carries a headlight on collar.



THREE RAILWAY TRACKS RISE ONE ABOVE ANOTHER

AN UNUSUAL railroad crossing is located at Seventeenth and Dock Streets, Richmond, Virginia. Tracks of three large trunk line railways cross each other at this point, one on the ground level, and the others at different heights on steel trestles. As Richmond is a busy railway center, trains are passing this point on one or another of these three levels almost constantly during the day and night.



MATCH SCRATCHER HOOKS TO STEERING WHEEL

FOR the driver who smokes, a new match scratcher that can be mounted on the steering wheel has just appeared. It carries a small oblong of abrasive material, and is held in place by a rubber tab that buttons tightly to one of the spokes. The device removes temptation to strike a match on the wheel or instrument board.

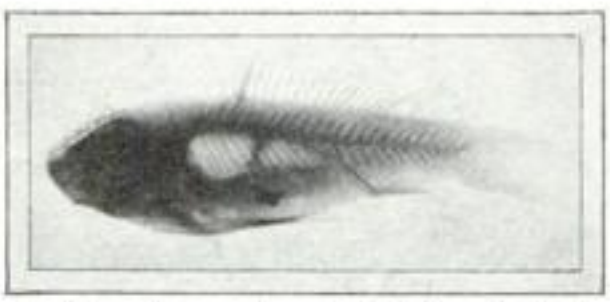
WORLD'S ONE FISH HOSPITAL KEPT BUSY

THE only fish hospital in the world is that run by James Palmer, of the Walker House Hotel Aquarium at Toronto, Canada. Patients are brought to it from all parts of Canada and the United States. They suffer from many of the ailments common to human beings, such as eye inflammation and consumption. The most common fish disease, however, is fungus, which is caused by changing the water too often.

In the hospital each sick pet is placed in an individual tank. Like cots in a human hospital ward, each has the patient's record on a chart hanging over it.

Operations are also performed on the fish. In one case, after all known methods of diagnosing fish ailments had failed, an X-ray was used on the patient, showing a stone lodged in its stomach. This was removed and the patient rapidly recovered.

Dieting forms an important part of the treatment of patients in the fish hospital. The invalids are fed on dried shrimp, calves' liver, whole-wheat bread, beef, codfish, and eggs.



An X-ray picture of a pet goldfish made in the world's only fish hospital at Toronto. At top, performing a life-saving operation on a patient.

BAD SMELLS NOW WARN MINERS OF DANGER

WHEN a miner notices a particularly bad smell in the air of the shaft, and sees the electric lights flash nine times, he knows that it is time to get out—quickly. That is the new danger signal recently adopted by the American Standards Association that will be used in metal mines in case of fire.

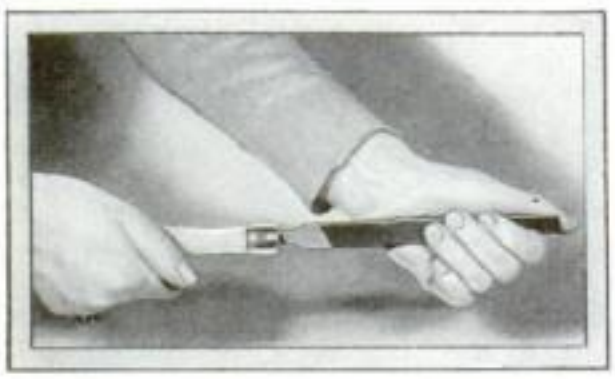
The United States Bureau of Mines, which tried out the scheme, first experimented with pleasant smells as a warning, but found bad ones more effective. The odors, used in liquid form, are sprayed into the ventilating shafts of the mine and shot underground along with fresh air at the rate of thousands of feet a minute. Odors found effective are butyl and ethyl mercaptan, which have the smell of decayed cabbage; butyric acid, suggestive of rancid butter; and banana oil, whose pungent aroma is like nothing else.

BIG TREES UNHARMED BY LAST YEAR'S DROUGHT

LAST year's dry spell did not damage trees as much as might be imagined, says the American Forestry Association. Since that body has not as yet received notice of many large trees being harmed, it is believed that small trees were the principal sufferers.

Among those hit hardest were the Ben Davis apple tree and dogwood in Pennsylvania, Maryland, and Virginia. This apple tree is considered one of the hardiest of its kind, but its high death rate was due to the unusually heavy crop that probably left it in a weakened condition. The dogwood died in great quantities because it grows in shady places, with its roots seeking to live in soil near the surface from which the larger trees had already extracted much of the nourishment.

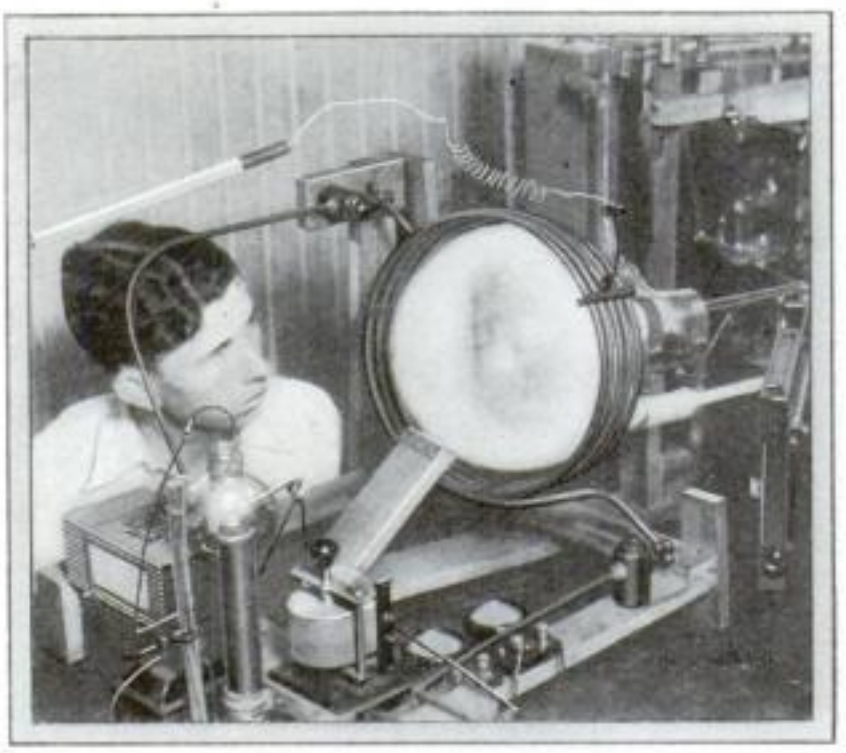
The Forestry Association believes that those trees whose leaves withered and fell early in the fall were unaffected by the dry spell and will be green again this spring. The Association's report says, however, that those trees whose leaves turned at an early date, but did not drop off until well into the winter months, are almost all dead.



UNIVERSAL FILE HANDLE SCREWS ONTO SHANK

A NEW convenience for home workshoppers is this file handle that screws on the shank of any file. In the screwing end is a die that cuts a thread on the metal shank. The result is a handle that can be detached at will, but which cannot come loose even when used in hard service.

FINDS BALL OF COLD FIRE IN DEADLY GAS

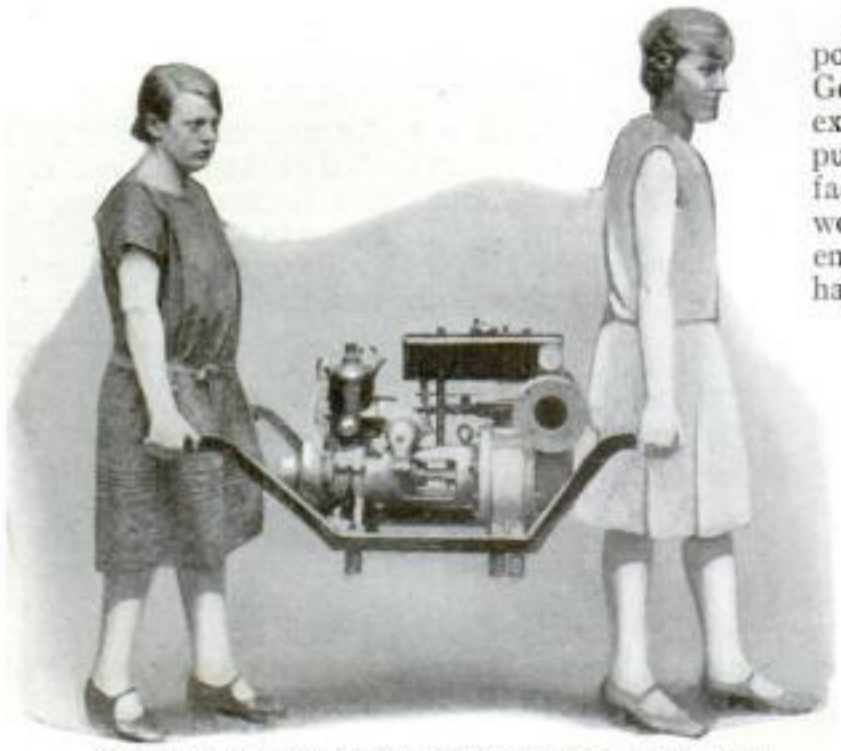


Jack C. Cotton, Columbus, Ohio, watching the ball of cold fire caused by a rapidly alternating current of electricity passing through metal tubing wound around the glass globe.

A STRANGE ball of cold fire, confined in a glass globe, is the plaything of Jack C. Cotton, of Columbus, O. While preparing for his master's degree in science at Ohio State University, he rigged up the apparatus shown in the picture. When he passes an electric current alternating 400,000 times a second through the spiral of metal tubing, a cold but firelike light glows within the globe. The vessel is filled with poisonous carbon monoxide gas.

There is no metallic connection between the coil and the gas. The phenomenon is called an "electrodeless ring discharge" by Cotton.

PORTABLE PUMP IS REAL FIRE ENGINE



This new portable pump, motor driven, so light that two women can carry it, makes a powerful fire engine.

A LITTLE motor-driven portable pump developed in Germany makes a handy fire extinguisher or emergency pumping apparatus for farms, factories, or construction works. So light that two women can easily carry it, it will handle as much as 20,000 gallons of water an hour. Its three-and-one-half-horsepower two-cycle water-cooled engine is so simple that no mechanic is needed to keep it in operation.

The motor runs on low grade fuel at from 1,400 to 1,600 revolutions per minute. It has a wide field of use in positions where permanent pumping installations are not available.

DESPISED WEED ADDS VALUE TO FARM LAND

FARMERS of the Imperial Valley, in California, have found wild hemp, a familiar weed, will in two or three months replenish exhausted soil as thoroughly as alfalfa and do the job more quickly. Wild hemp grows abundantly from the Atlantic to the Pacific Coast, and from the Mason-Dixon line south to an undetermined point in Central America. In a few weeks it towers seven to ten feet high and is of jungle thickness. According to D. E. Creighton, assistant farm adviser of Imperial County, discovery of its ability to enrich soil may prove the greatest advance in farming since water was brought in to irrigate the American Desert.

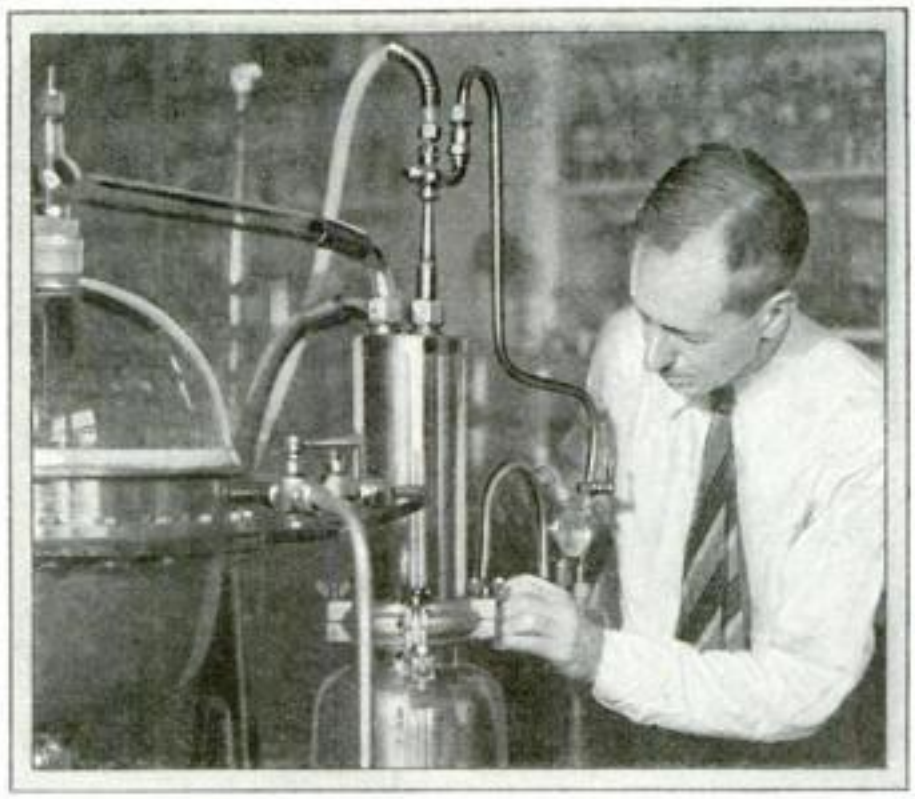
During the months when the soil is "resting" the depleted land is plowed and seeded with wild hemp. Tractor machinery then plows under the luxuriant crop, stalks and all. The formerly-despised weed is now said to be adding from ten to twenty-five percent to the $12,000,000 crops of the Imperial Valley.

FRUIT FLAVOR PROBED IN VACUUM STILL

WHAT makes a cherry taste like a cherry and a peach like a peach? To find answers to these questions, E. K. Nelson, of the Chemistry Bureau of the Department of Agriculture, is making experiments with a new type of still, recently imported from Germany. The new apparatus is being used to isolate and study the essential oils of different fruits and determine their exact chemical composition.

The new still makes use of the fact that as air pressure decreases, the boiling point lowers. Within the vacuum chamber of the new still the liquid comes to a boil quickly at comparatively low temperatures.

Discovery of what gives a fruit its taste would help in the production of artificial flavors.



With this vacuum still, chemists in the Department of Agriculture are searching for the secret of flavoring in fruits.

LOPSIDED GOLF BALL PICKED OUT BY GAGE

BECAUSE a lopsided golf ball may spoil a player's game, a midwestern firm has devised a "golf ball gage" to test its trueness. A good ball should pass freely through one of the circular openings. Two apertures, of 1.62 and 1.68 inch diameter, permit both the old and the new standard golf balls to be tested. The tester is small enough to be carried in the golfer's pocket or in the ball compartment of the golf bag.

Golf ball gage which tests both new and old size balls and shows if they are lopsided.

SIBERIAN WOLVES MAY HOWL IN MICROPHONE

PACKS of wolves that infest the plains of Siberia will announce their presence through microphones, in a plan proposed recently by scientists of Soviet Russia. At intervals throughout the country, microphones like those used by radio broadcasters would be hung on trees and posts, and connected by wire with a central telephone exchange or listening-post.

When the operator at the "wolf central" heard the howls of a pack, he could locate it at once with the aid of a map showing the position of the microphone, and dispatch rangers or volunteer hunters to exterminate the animals. The scheme is being urged in an effort to conquer the wolf menace, which has made travel dangerous in large areas of Siberia.

MACHINE DIGS UP OLD ROAD, LAYS NEW ONE

OLD gravel roads go into one end of this strange machine, coming out at its other end in the form of new ones. It moves along over highways breaking up the surface, picking up the chunks, mixing them with a "bituminous binder"—a tarlike by-product of soft coal—and re-laying it in the form of a new road.

The machine, developed in Cedar Rapids, Iowa, travels under its own power, and it is claimed will do the work of several road gangs and save much time.

EVERYBODY IS HAPPY, PSYCHOLOGIST FINDS

MOST people like to call themselves happy, according to Dr. Randolph Sailer, psychologist at Yenching University, China. Only sixty workers out of 500 whom he questioned admitted that they were less happy than the average mortal. None was a complete pessimist.

Money, jobs, and education seem to have nothing to do with happiness, Dr. Sailer and his coworkers have found. Smokers and nonsmokers are both happy. Men are happier, as a rule, when married.

ICE BOX GALE TESTS WARMTH OF CLOTH

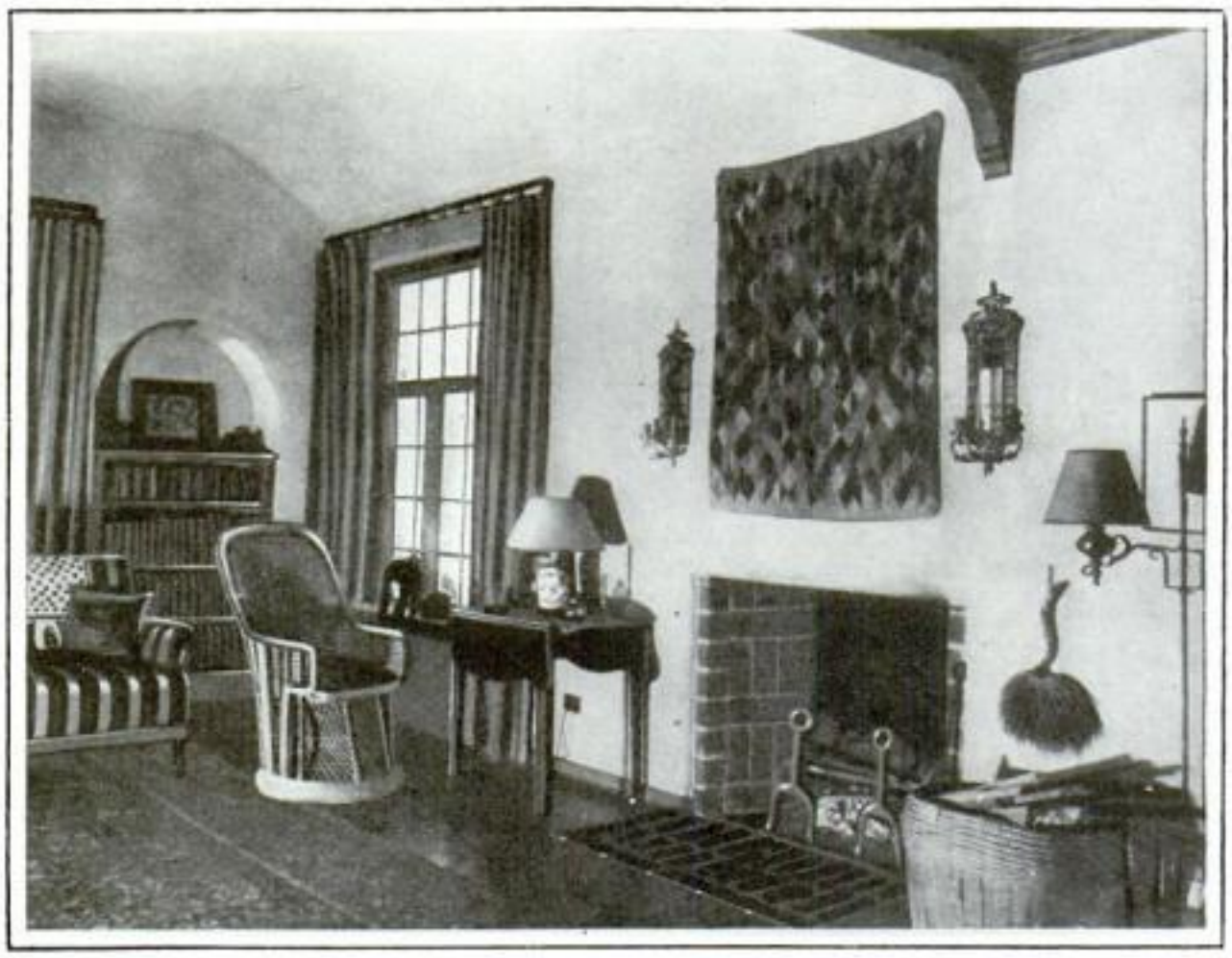
A NEW YORK department store finds out how warm overcoats are by testing material in this apparatus which measures the amount of heat that can escape through the fabric. The heating element around which the cloth is wrapped is maintained at 98.6 degrees Fahrenheit by electricity. It is placed over the opening in the electric refrigerator on which it stands, and a fan blows cold air over it in imitation of a severe winter gale.

The cloth's resistance to cold shows on dials on top of the apparatus. Ephraim Freedman, who designed it, has found Alaska seal to be the warmest garment material he has tested on it.

Cloth wrapped around heating element is exposed to icy blast from refrigerator to test cold resisting quality.

The Architect Builds His Own Home—A Series

Design Your House to Fit Its Site

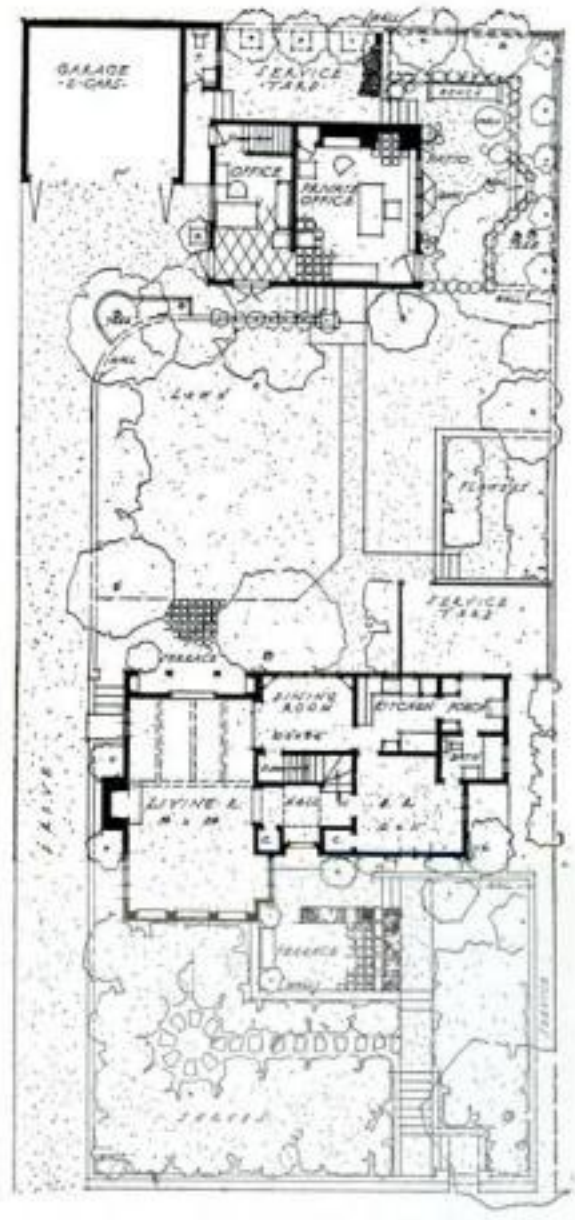


Before the fireplace in the living room of the Risley home in Los Angeles, Calif. This room has windows on four sides but in spite of that the arrangement gives large wall space.

By

W. L. RISLEY

Los Angeles architect, who built dwelling on unusual shaped lot and won honor award, describes it for you



This plan shows the arrangement of the ground floor in the house and office.

A NUMBER of interesting conditions were to be met when the house shown in the accompanying photographs and plans was designed and built. The lot was sixty by 130 feet in size, with the street end facing to the west. The land rose about twenty feet from front to rear, giving a grade of approximately one in eight, and necessitating, for such a small lot, numerous retaining walls, terraces, and different levels.

Since the soil is *adobe* and expands when wet, special precautions were taken to insure each level being properly drained. Inasmuch as large trees are not as plentiful in Los Angeles as in the East, the five quite large eucalypti, in scattered locations, were to be kept, and the house built around them.

To obtain the fine view of the Hollywood Hills on the north, and yet not deprive the home of the much needed sunlight from the other points of the compass, an L-shaped plan was drawn.

These conditions combined to make the designing of this place quite different from that of the usual city small home on a level lot. The frank acceptance of unusual locations generally results in homes that seem to fit their sites.

Local zoning ordinances fixed the exact distance of the front of the building from the street. After the number of rooms and their general size was determined, the next step was the locating of the main garden, with a view to the accessibility of the principal rooms to and from it. A glance at the accompanying plan will show clearly how this was accomplished.

Due to the steepness of the lot at the front, and the continued rise from street end to rear, it was necessary to build a high retaining wall

One of the attractive nooks in the Risley garden. Note how it is screened from the street.

Interior of the office, showing fireplace and the battery of windows, with built-in drawers below, overlooking patio.

which, as shown in the photograph, was stepped down to follow the gradient of the street, giving continually increasing impressions of size to the garden. This condition also permitted rather unusual treatment on the entrance steps, which lead up to the main entry by way of several terraces, overcoming without effort the rise of the land.

At the foot of the steps, an electric light is set behind frosted glass, flush with the wall and about waist high. Over and around this grows English ivy, so that when the light is turned on, the appearance of an ever-changing pattern is given. Steps and terrace are flanked by hedges and foliage plants.

Owing to the steepness of the slope at the front there is no lawn. Instead, the planting is arranged to give privacy and block out the street so that, as one looks from the windows of the first floor across the garden and in unbroken vision to the gardens of the homes across the street, there is no apparent intrusion of any thoroughfare.

All the trees, hedges, foliage plants, and so on were carefully planned and placed to enhance the architecture of the house. A complete sprinkler system, with the sprinkler heads adjustable in height, makes watering an easy task.

From the front, the house gives little evidence of having two full stories, yet there are two bedrooms, bath, and attic on the second floor. The main entrance was inspired by an old Cotswold doorway, and a stone tablet over the doorway carries the initials of the owners and the date the house was built. In a way, this seems to indicate that the structure was erected as a permanent home, and not as a transitory dwelling-place or one "built for sale."

The service entrance is on the south side and is entirely planted out, so that tradespeople using it are never visible to occupants or their guests in the first-floor rooms or the garden. This planting, as well as that in the front and in the garden, insures privacy. Due to position on the lot, and the planting, it is impossible to see into the first-floor rooms either from the street or the two sides. Such planting also adds to the beauty of the completed establishment as a whole, and makes glimpses of the house more alluring than landscaping where the front of the building is left open to view.

Exterior view of the Risley home. The house, in spite of its low elevation, is full two stories in height and was designed to blend perfectly with its surrounding trees and foliage.

The living room, dining room, kitchen, and two upstairs bedrooms all face east, thus enjoying not only morning sunshine, but all the privacy and quiet beauty of the garden. Off the living room is a small terrace, flanked by a large eucalyptus tree and surrounded by potted plants, forming a pleasant spot for the serving of meals out-of-doors. It was necessary to cut back the roof at the eave to permit this fine tree to remain where it was.

A paved terrace in the garden. Shrubbery hides this retreat from the street.

The floor of the terrace, paved with red square brick set in cement, makes a convenient place to water the plants and is easy to keep clean. On the upper garden wall, opposite the terrace, is a small fountain with a border of old Mexican tiles in soft blues and yellows.

Study of the plans will reveal that our house is most compact, with little space for halls. It contains, downstairs, a living room, small dining room paneled in Oregon pine, kitchen, back porch, and small bedroom so designed that it may be used as a guest room, study, or maid's room, as needed. A bathroom attached to this bedroom also connects with the back porch. Upstairs are the master's bedroom, a guest room, and bath.

Floors, with the exception of those in the bathrooms, hall, and kitchen, are select oak, stained almost black. Kitchen and screen porch have linoleum flooring, while red quarry tile is used in the bathrooms. The tiling in the hall was found in the "junk pile" of a tile yard, and ranges from red to tawny yellow. It is quite rough in texture, undoubtedly the reason for being discarded. Yet it blends beautifully with the Oriental rugs in the living room, and wears well.

Woodwork of the entire house, with the exception of the kitchen and bathrooms, is finished in silver gray. The wood was first stained dark with acid and then waxed. Rottenstone was added to the wax to give it a gray color. Walls are of steel-troweled plaster of a warm neutral color. Windows are steel cottage casements, with disappearing rolling screens. Electrically controlled gas furnaces supply heat.

Draperies in the living and dining rooms are Spanish homespun wool, of a warm parchment shade. Old Oriental rugs and some fine Chinese Khassas give color and warmth to the interior. An effort was made to so design and finish the interior of this home as to make it a background for furnishings.

An unusual feature of the living room is that it has four exposures and yet has considerable wall space. There are no fixed electric (Continued on page 145)

Tradesmen's entrance. This door and the path that leads to it are blocked off and cannot be seen from rest of house.

Improved Tools to Make *Housework* Easy

MAKE ICE BOX COOKIES. Ripening dough in a refrigerator is a method used by the best bakers. A new set of cookie molds, in which dough is locked, makes it easy for any housewife to do the same.

HEATER AS **CUT FLOWER** STAND. Resembling a console radio, this gas-fired heater is an attractive addition to any room. It directs a current of warm air towards the center of the room and the top is so well insulated against heat that fresh flowers may be put on it without wilting.

SPRAY TO COOL BOTTLES. When this rubber ring is slipped over a bottle and the tube connected to the faucet a chilling spray pours around the bottle.

MINIATURE DRY CLEANER. Small articles can be dry cleaned at home now in a jar containing cleaning fluid. The articles are swished up and down in the jar.

RADIO RECIPE BOOK. Indexed for ready reference, a new radio recipe book has just appeared on the market. It should prove useful to the housewife who follows broadcast cooking directions of which she wants to make notes.

A BUILT-IN STRAINER. A new style cook pot has a strainer that arches halfway over its top, permanently attached to it. When vegetables are cooked the water is poured off through the sieve. Handles at the sides make a firm grasp possible. Tongs for removing vegetables are unnecessary.

HANDY GLASS JARS FOR CEREALS. Less mussy and more convenient than the original packages are glass containers that nest in a compact group. Sloping fronts with close fitting air-tight tops keep the jar tightly closed, preventing the cereal from getting stale.

ALUMINUM MIXING STICKS. These new "swizzle sticks" can be twirled rapidly by rubbing them between the palms of the hand. The small size fits cup or glass; the larger is used with bowl or pitcher.

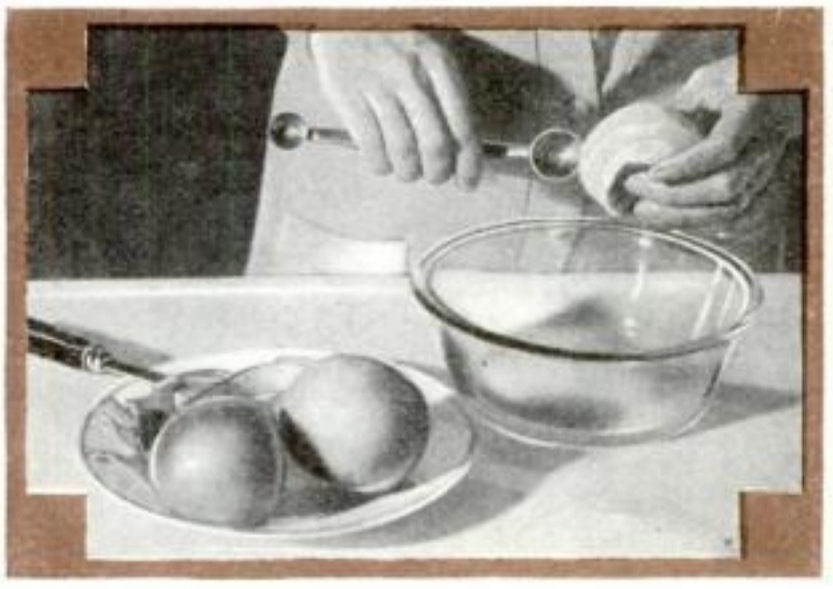
TEA CART AND BRIDGE TABLE COMBINED. Ingenious trickery in design makes it possible to convert this versatile piece of furniture from a tea wagon into a bridge table at a moment's notice. In the illustration above the change has just been made and the hostess now has a table for a game of cards. Those who live in small apartments will like its space-saving advantages.

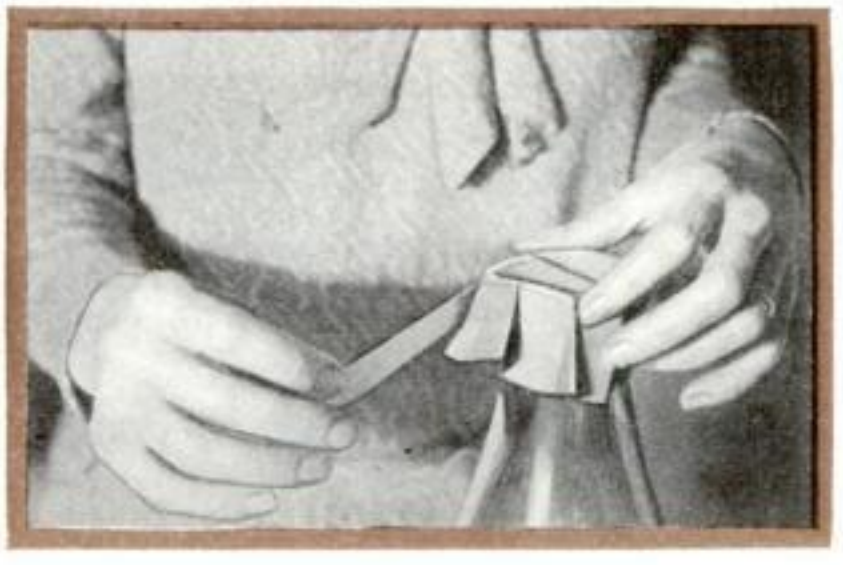
KEEPS SEWING KIT AT HAND. This new fire screen is more than simply attractive. While it serves perfectly its purpose as a screen it also contains a compartment at the end large enough to store complete equipment for sewing with shelves for stationery.

HERE IT'S A TEA CART. By removing the lower tray of this tea wagon it can be quickly converted into the bridge table seen in photo at upper left.

HOLDER FOR STOVE RINGS. An added convenience for coal ranges is this rack for the various sized rings. When several of them are removed in adjusting the size of the opening to the pot to be used, they may be hung for ready use, and yet out of the way, on these small arms.

TWIN FRUIT BALLER. Two tools in one is this double-ended fruit baller, right, which is convenient for preparing desserts and salads in an attractive way. One end contains a large cutter and the other a small one for fruits and vegetables.





MILK BOTTLE SEAL. When a bottle of milk has been opened, it can be sealed in a sanitary manner with one of these new paper seals which successfully closes it against dust, flies, and household pets. The brown paper disk folds down around the bottle and a gummed paper tab encircles the neck to hold the seal securely in position.

POPULAR SCIENCE MONTHLY

RAYMOND J. BROWN, *Editor*
ARTHUR WAKELING, Home Workshop Editor
ALFRED P. LANE, Technical Editor
ISRAEL DOSKOW, Art Editor

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America's Healthiest Year

ACCORDING to the mass of statistics compiled by one of our largest life insurance companies, the people of the United States and Canada enjoyed better health during 1930 than in any previous year.

However, before we start patting ourselves on the back perhaps we had better see whether we are really entitled to any credit for this fine showing.

According to the figures, there is a general falling off in the number of deaths from communicable diseases such as typhoid, diphtheria, influenza, tuberculosis, and so on. But there has been an increase in the number of deaths caused by suicides, homicides, and automobile accidents.

It seems that the doctors, by keeping eternally at it, have literally forced us to take the precautions that will prevent the spread of infectious diseases. They have, indeed, forced us to reduce deaths from these diseases more than enough to counterbalance suicides, murders and highway accidents over which the doctors, unfortunately, have no control.

It seems fitting therefore that POPULAR SCIENCE MONTHLY's $10,000 award for scientific achievement should go to the medical profession.

Are Business Leaders All Dead?

BUSINESS has slowed down. Millions of men who want work can't get it. Their families are in want, and relief plans are flourishing everywhere. Economists say the cause is overproduction and speculation, and everybody is waiting for a "turn" in business.

This is not the whole story. It is difficult to picture the industrial leaders of America waiting like gamblers for their luck to change; and yet, in the existing crisis, business does seem to be suffering from a conspicuous lack of courage and brains.

The business man who discharges employees because he feels that he has to cut expenses actually is admitting that with all his money, all his credit, all his brains, and all his experience he is unable to think of a way to use labor to produce something that can be traded to somebody else for what it cost plus a fair profit.

Most business men apparently aren't thinking very hard or they would find a thousand things that people want and are willing to pay for but cannot get. Neither, in general, are our statesmen and political leaders, for the undertaking of needed public work would do much to relieve the present depression.

For example, there are undoubtedly thousands of people in the vicinity of New York City who would gladly pay for the privilege of driving their automobiles through a tunnel under the East River to Long Island. Such a tunnel was completed under the Hudson river between New York and New Jersey three years ago. It cost $50,000,000 and between 5,000 and 7,000 men worked on it for seven years. It will pay for itself within ten years, meanwhile paying from eight to nine percent on the investment. Already another tunnel twice as large is needed at the same place. Only two of the great railroad systems have terminals in New York. The rest dump their passengers off on the New Jersey shore, letting them find their way to New York by ferry or tube, as they can. Present-day conditions demand that these roads construct a union terminal in New York with a connecting tube under the Hudson river.

These projects would not solve the unemployment problem, even for New York City, but, if they were attempted now, they might serve as a spur to business, for they would indicate that some of those to whom we look for leadership possess brains enough to seek a remedy for an evil condition and courage enough to prosecute difficult work in face of the cry of "hard times."

Deeds Rather Than Words

PUBLIC SAFETY, an interesting little magazine published by the National Safety Council, has been conducting what it calls a "national word hunt," seeking a short synonym for "motor vehicle fatality," which it regards as a "cumbersome term."

Public Safety's own candidate is "autocide." Various readers of the magazine have put forward "motorcide," "highwaycide," "carricide," "movehtality," and "M. V. F." (the initial letters of "motor vehicle fatality") as substitutes for the "cumbersome term."

Now of course any student of English will tell you that the "cumbersome term" itself is pretty bad. "Fatality" becomes a synonym for "death" only in its secondary meaning. But the efforts of *Public Safety* and its readers thus far seem to us only to have made a bad thing worse.

It would not be a bad idea for *Public Safety* and its readers to get out their grammars and read the section on etymology which gives the rules of the game they are trying to play. If "regicide," for example, means the "killer of a king," or the "killing of a king," and "parricide" means the "killer of a near relative," or the "killing of a near relative," then "motorcide," "highwayside," and the others obviously cannot mean anything but the killer or killing of a motor, a highway, and so on.

Meanwhile, we might suggest that those whom the phrase "motor vehicle fatality" offends would be performing a more useful work if, instead of seeking a substitute, they sought to remove the necessity for its use by preaching careful driving.

Changing Jobs to Work Harder

HAROLD K. PATTERSON, whose remarkable success in concocting "plant pills" was described last month, has written us a very interesting letter. He states that the recording of his experiments in cold type has inspired him to apply for a position with a large fertilizer manufacturer.

The chances are that Patterson will be a success at his new occupation, not simply because he made a shift, but because of the reasons back of that shift.

To begin with, he is going into the fertilizer business not as a soft snap that will bring him lots of money for little work. He isn't looking at it that way at all. He wants to work and work hard and he thinks that with the particular type of brain with which nature has endowed him, he can work harder and more effectively in the fertilizer business than he could at selling furniture.

The world, unfortunately, is full of misfits—men doing jobs for which they have no natural ability and no instinctive liking. To the misfits, Patterson's experience will stand out as a lighthouse in a fog of uncertainty.

If such a man can only discover what it is that he can learn to do well and then put his heart and soul into acquiring the necessary knowledge and skill, he may follow Patterson's footsteps with high hopes.

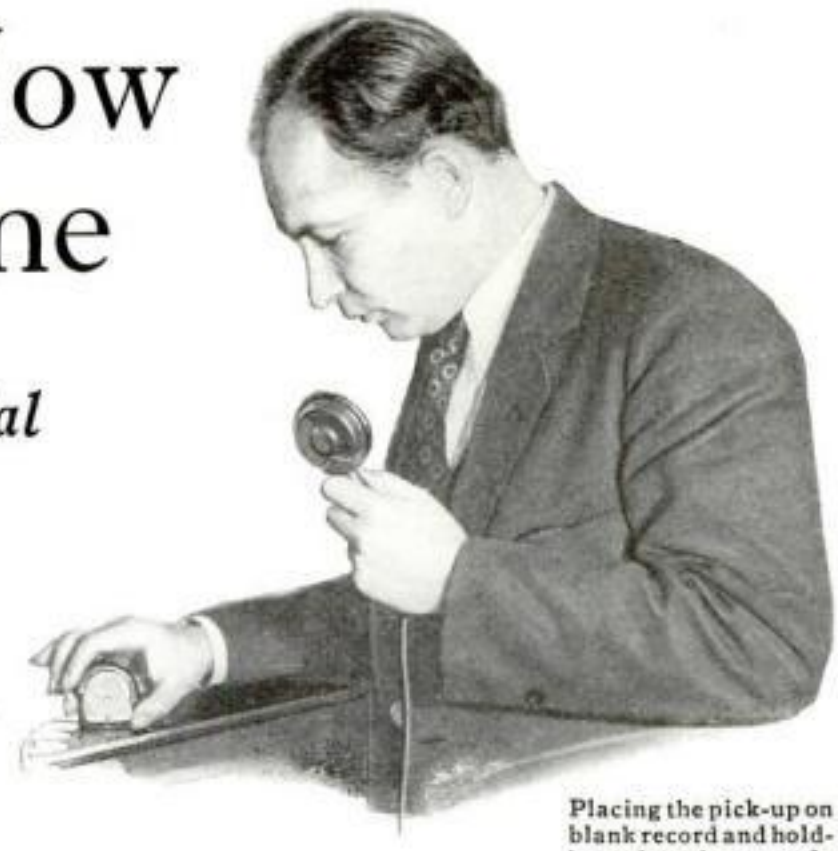
It may be well to point out, however, that the lazy, indolent chap who is merely looking for an easy berth had better stay where he is. It takes less work to keep on with your present occupation than it does to take up a new one.

Radio Programs Now Recorded at Home

Grooved Blank Disk with Special Steel Needle Makes It Easy for You to "Can" All Music or Speech at Will

By

JOHN CARR



Placing the pick-up on blank record and holding microphone ready to make the record.

RECENT developments make possible the home recording of radio programs on disk records that can be played again on any type of phonograph that will handle the conventional type of disk record.

This new form of home entertainment will find many uses. The children's voices may be "canned" for future reference. Personal greetings by voice can be sent to friends and relatives who live far away. Exceptional radio programs can be preserved for replaying whenever desired. And the entertainment possibilities of breaking up the ordinary radio or phonograph program with a bit of home talent comedy is obvious.

Home recording has been made practical by the production of a pregrooved blank record capable of taking an impression from a special steel needle. This pregrooved record blank eliminated at one stroke all the complicated apparatus used in commercial recording studios to guide the needle so that it would form the fine spiral groove as it recorded the sound.

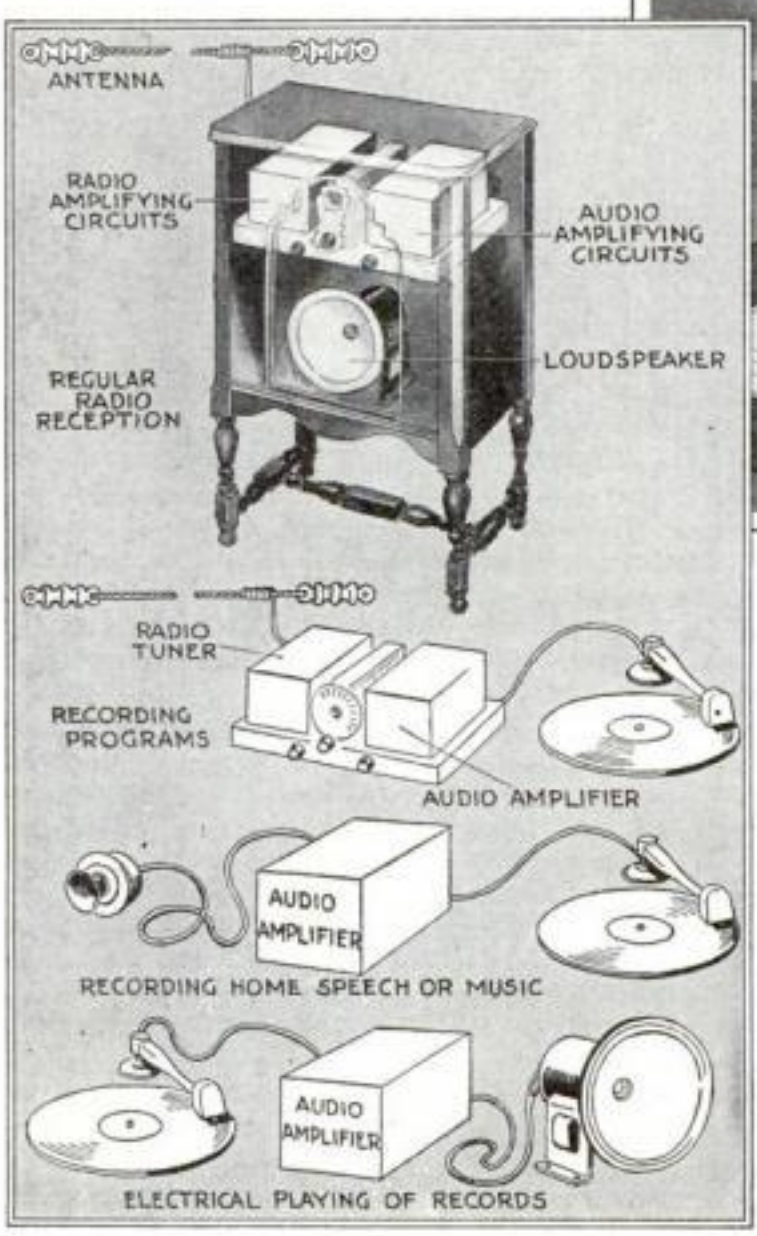


Fig. 1. Drawings above show how audio amplifier always is used in radio reception or in making or playing a record.

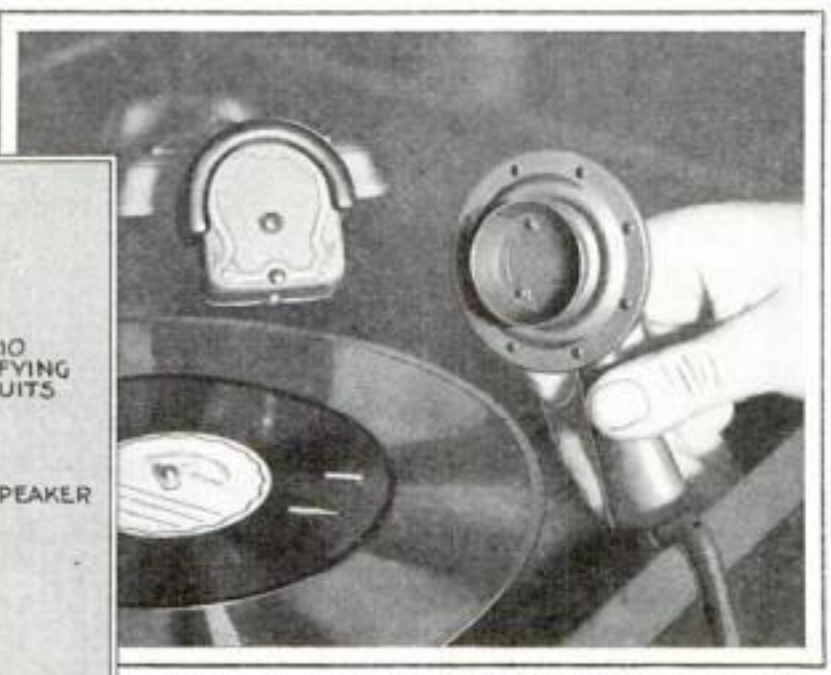


Fig. 2. The microphone to make records, grooved disk, special and playing needle, and pick-up.

Of course it must be understood that home recording by such simple methods does not approach in technical perfection the commercially produced record. The latter is made with the finest and most nearly accurate apparatus available. Home recorded speech, however, is clear and understandable and the reproduction of music under such conditions is all that could be expected.

Home recording now can be done by any radio fan who has a radio receiver that embodies at least two stages of audio amplification and who also possesses any one of the standard electric pick-ups designed for the electrical playing of phonograph records of the disk type.

If you wish only to record the music or speech heard over the radio, you need no additional apparatus beyond a supply of the blank records and a couple of recording needles. These can be obtained from a dealer in phonographic supplies. If you also wish to record speech or home musical talent, you need, in addition, a microphone or some substitute to pick up the voices or music.

The one indispensable part of a home recording set-up is the audio amplifier. The illustrations in Fig. 1 show how the audio amplifier always is used whether you are receiving radio on the loudspeaker, recording a radio program on a record, recording voice or music, or electrically playing records of either the homemade or "store" variety.

In your radio receiver, the function of the audio amplifier is to take the weak electrical equivalent of the sound impulses fed into it by the detector tube and amplify them to the point where they will operate a loudspeaker. In any of the operations above mentioned, the function of the audio amplifier is exactly the same—to take weak electrical impulses and turn them into powerful ones.

The procedure in recording radio programs is the simplest of all. You merely connect the phonograph pick-up to the output of the set, use a recording needle in place of the one with which you play records, and put one of the blank records on the turntable.

It is well to add a little extra weight to the phonograph pick-up so it will press the recording needle more tightly against the record. The amount of extra weight can be determined by experiment. It will be only a few ounces at most, and is governed by the weight *(Continued on page 139)*

Old Circuit Comes Back

Superheterodyne Vastly Improved by Use of Recent Radio Developments

By ALFRED P. LANE

One of the new superheterodyne receiving sets is being examined in the laboratory of Popular Science Institute.

THE superheterodyne radio receiving circuit, which still remains an unsolved mystery to most radio enthusiasts, has been rejuvenated. Its bad features have been removed and its good features greatly improved.

This remarkable circuit was a war baby, an emergency solution of the problem of intercepting the enemy's extremely weak radio signals. While Edwin H. Armstrong, the inventor, is better known to old-time radio fans in connection with the regenerative circuit, it is the "super" which entitles him to lasting fame.

When the radio vacuum tube was first introduced, attempts were made to design circuits that would amplify at radio frequency. The early tubes were satisfactory in such circuits only when the frequency was relatively low. The higher the frequency, the poorer the amplification that was obtained, so that while fair results could be secured on the frequencies we now use for broadcasting, the still higher frequencies gave virtually negative results.

The superheterodyne circuit got around this trouble by converting the high frequency of the incoming radio wave to a lower frequency wave and then amplifying at this lower frequency.

THE method used to obtain the lower frequency is most ingenious. In the original "super" design, the incoming radio signal was fed directly into an ordinary detector tube circuit.

Another tube, called the oscillator because its only function was to produce a continuous stream of radio-frequency oscillations, was controlled by a separate knob so that it could be made to work at any frequency within the range of the detector tuning circuit.

The radio wave as reproduced by the detector and the high frequency electrical oscillations of the oscillator tube were fed into the same electrical circuit. If the oscillator happened to be set to produce exactly the same frequency as that of the incoming radio wave, the two frequencies would, figuratively speaking, drop into step with each other and travel along through the rest of the circuit in the most friendly fashion. The result from a reception standpoint would be nil.

But if the oscillator were set for a frequency differing from that of the incoming wave, the two couldn't keep step continuously—first they would be in step, then out of step, then in step. The same thing happens when two men with different strides walk together.

OBVIOUSLY, if the incoming radio wave had a frequency of, say, 1,500,000 cycles and the oscillator produced a frequency of 1,325,000 cycles, they would go through the in-step, out-of-step cycle at the rate of 175,000 cycles a second, a much lower and more easily amplified frequency. The rest of the circuit design of the original superheterodyne was simple. Armstrong built a special amplifier that would work on this one frequency and no other. He called it the intermediate frequency amplifier and that designation is still used. To obtain strong results from a weak incoming radio signal he set his oscillator so as to obtain the 175,000 in-step, out-of-step cycle difference.

Right here bobbed up one of the most serious defects of the original superheterodyne circuit—a defect that troubled owners of early types of receivers using this circuit. You could obtain the difference of 175,000 cycles whether you tuned the oscillator that number of cycles above that of the incoming wave or the same amount below it. In either case you got the station.

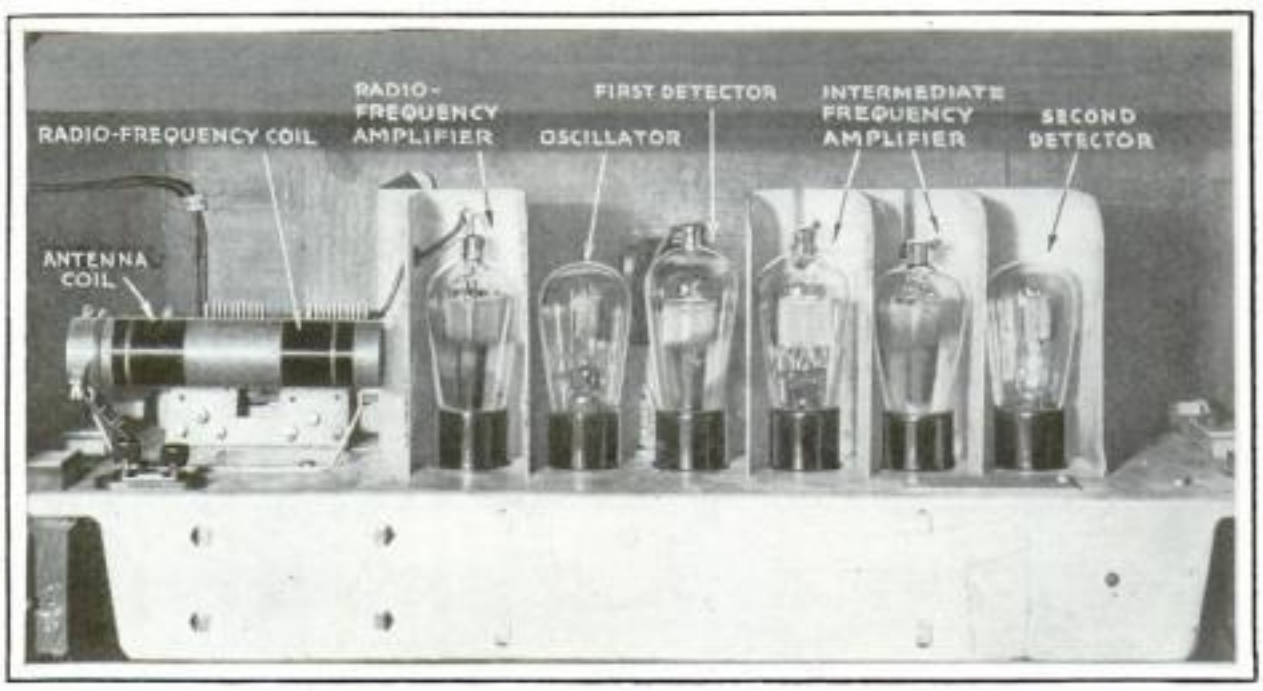
THAT wasn't so bad when there were only a few stations broadcasting and there was plenty of room on the dial for two points for each station, but under modern conditions it would be pretty hopeless. The lower point for one station would be almost certain to coincide with the upper point of some other station and the result would be hash.

Engineers tried various schemes to overcome this defect of the superheterodyne. Almost every possible intermediate frequency was tried but that only cleared part of the dial.

In the meantime the introduction of screen grid tubes and other new developments improved the ordinary tuned radio-frequency circuits until it seemed that the superheterodyne might have to take a back seat.

But the improvement in tuned radio-frequency amplification has also provided a way to eliminate double point tuning in the superheterodyne. Modern radio-frequency amplifier and preselector circuits were grafted onto the front end of the super circuit and the screen grid tube was used in the intermediate stages. Then the oscillator frequency changing condenser was hitched to the tuning dial.

It is easy *(Continued on page 139)*



The above picture shows the arrangements of the various tubes in the most highly developed superheterodyne sets, in which the many advantages of this circuit are brought out.

USEFUL HINTS FOR RADIO FANS

Latest Sets Can Use Light Socket Aerials

THE extreme sensitiveness of the modern radio receiver has renewed interest in the idea of using the electric light wiring as an antenna. Under ordinary conditions, the light socket antenna does not bring in signals as well as does a properly constructed outdoor antenna. But with the modern set, the strength of signal picked up from the light lines usually is ample for all ordinary reception.

The illustration of Fig. 4 shows what an attractive form the light socket antenna may take. In this case a model stagecoach lamp designed to be placed on top of the radio cabinet looks and acts like any other decorative lighting fixture. There is the usual cord to be plugged into the wall socket and in addition a single wire to be connected to the antenna binding post of the radio set. Any table lamp could be used for the same purpose.

Electrically, a light socket antenna, no matter what its appearance or size, consists of nothing but a small fixed capacity mica condenser, one terminal of which is connected to the light wiring. The other terminal is connected to the antenna binding post of the set. The diagram of Fig. 2 shows the circuit.

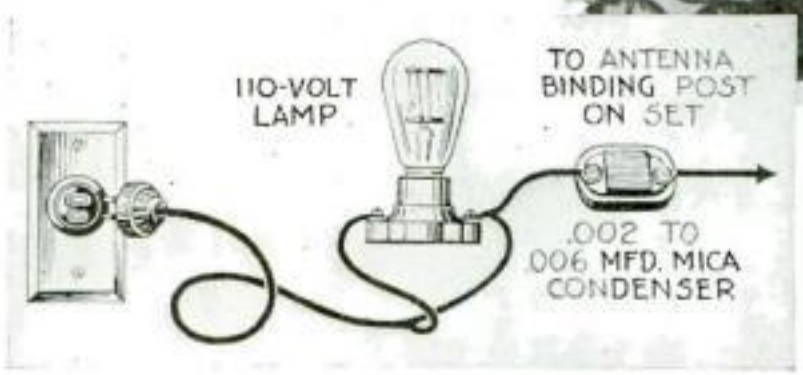


Fig. 2. This diagram shows a simple hook-up by means of which electric wiring serves as antenna.

SIMPLE CHOKE COILS

RADIO beginners often are confused by the technical terms used to designate relatively simple radio apparatus. The term "radio-frequency choke coil" is a case in point. Anything with a name like that ought to be quite complicated and

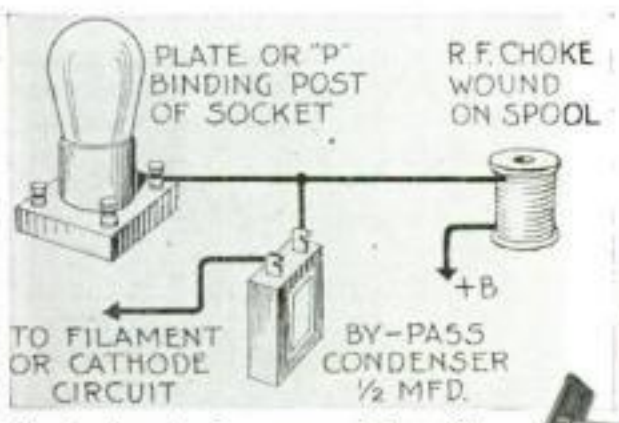


Fig. 1. A radio-frequency choke coil installed in a B circuit with condenser.

elaborate. Actually it isn't. A radio-frequency choke coil—often abbreviated to R. F. choke—is nothing but a small spool of fine wire wound in such a way that the electrical capacity or condenser effect between the turns of wire in the coil is at a minimum.

The function of a radio-frequency choke is to block the flow of high-frequency current in the circuit in which it is placed and yet allow the low-frequency audible currents to get by unimpeded. It is, in a way, like a fence high enough to stop small animals yet low enough so that a big animal can walk over it.

High-frequency current, such as the wave from a broadcasting station, seems to have a special aversion to being whirled around and around in the turns of a coil of wire unless the number of turns makes the coil tune to the particular frequency of the current.

Consequently the design of an R. F. choke coil is not exact as far as the number of turns of wire is concerned. It is only necessary to make sure that you have enough turns to make the natural tuning of the coil beyond the range of the broadcast waves. It takes about five or six hundred turns to do this if the coil is as big around as an ordinary thread spool.

Fig. 3. Wind your own radio-frequency choke coils as shown above, letting the wire go back and forth at random as demonstrated in the photo at right.

To get so many turns into such a small space it is necessary to use fine wire such as No. 32. Figure 3 shows how to wind your own radio-frequency choke coils using thread spools for forms and No. 32 double covered wire for the winding. The hand drill can be clamped into the bench vise and used to rotate the spool as shown. A drill or a metal or wood rod can be used as a mandrel.

Strange as it may seem, the more careless you are with the winding, the more effective the coil as a radio-frequency choke. The worst thing you can do is to wind the wire in smooth and even layers. Wind it back and forth at random as shown in the circle, Fig. 3.

The most common use of the R. F. coil is to isolate radio-frequency amplifier plate circuits from each other where there would otherwise be interaction by way of the common B supply. Figure 1 shows a radio-frequency choke coil installed in a B circuit with, of course, the by-pass condenser that is necessary to provide a return path for the radio-frequency current. Another use is in the plate circuit of the detector tube to prevent radio-frequency current from passing along into the audio amplifier and causing mysterious overloading troubles.

When a choke coil is used, a by-pass condenser is also required to complete circuit.

Fig. 4. Your electric light socket antenna can take this attractive form and stand on radio cabinet.

Heat Your Car but Don't Burn It!

By
MARTIN BUNN

Gus charged out with a fire extinguisher as the owner dragged the rug out of the car.

JOE CLARK, pencil in hand, was checking the day's gasoline total on the pump outside the Model Garage when a sedan drew up.

"Fill her up!" the driver called. "Got a long trip ahead of us tomorrow." He stepped out and came around to watch.

Joe casually glanced at the attractive woman seated in the car as he ground the crank. She was leaning forward, apparently searching for something on the floor. Then suddenly she sat up with a jerk and yelled "Fire!" at the top of her lungs.

Joe stopped cranking and took up the call. Gus Wilson, his partner, came charging out of the garage with a fat and shiny fire extinguisher.

The owner of the car with one sweep dragged out the lap robe and with it the smoldering remains of a newspaper. The woman immediately hopped out and the men searched for the cause of the fire.

"What's that gadget there?" Gus asked, pointing to a piece of pipe placed crosswise on the floor boards just back of the front seat.

"That's a new car heater I built myself," the owner replied. He placed his fingers on the pipe and instantly jerked them away again. "Ouch!" he howled, shaking his hand. "That pipe sure is hot!"

"I guess we don't have to look any further," said Gus. "The newspaper must have been on the pipe and the robe kept the heat in till it got nearly red-hot."

THE owner bent over to examine the pipe "I certainly am disgusted," he said, "after all the work I put into building that heater."

"You did a good job—as far as you went," reported Gus after checking up on the whole installation. "You got everything tight so no exhaust gas could leak out into the body of the car. But you didn't insulate the pipe from the wood of the floor boards well enough. There ought to be plenty of asbestos separating every part of the outfit from anything that can burn. And you didn't put any guard over it."

"I had no idea the pipe would get so hot," confessed the owner. "I felt of the exhaust tail pipe and it seemed to be just the right heat for a car heater."

Gus Says—

THERE'S one sure way to tell a beginner from an experienced auto driver. Watch him when he passes another car. The beginner swerves way out in the road to pass and cuts back too soon. The experienced driver gets by without swinging out too far and never cuts back again too soon.

GUS smiled. "You forgot that the exhaust gases cool a lot in the muffler. You're taking them out of the exhaust line right back of the motor where they're hottest. Anyhow, plenty of heat certainly isn't a fault in a car heater. If you just insulate it properly and fit a strong wire screen over the pipe on the floor, so nothing can get nearer than an inch or two to it, everything will be fine and dandy."

But the owner's wife cut into the conversation.

"Charlie Green!" she exclaimed. "If you don't have the man take that thing out of the car this minute you'll make the rest of the trip alone! I'd rather freeze to death than be fried to a crisp!"

Green shrugged his shoulders and yielded. "All right," he agreed. "I'll take you down to the hotel and then bring the car back here."

They drove off with Mrs. Green warily eyeing the pipe as though she expected it to blow up.

When the car returned, Gus set to work at once while Green gloomily watched the destruction of his handiwork.

"I suppose you've got to satisfy the women," Gus grunted. "Still, Mr. Green, you don't have to go without a heater just because your wife is afraid of this one. I'll install a good one if you say so."

Green's face brightened at once. "That's an idea," he said. "What kind of a heater do you sell?"

"We don't play favorites," Gus smiled. "I can give you any one of three different kinds. Properly installed, you get fine results out of any of 'em."

"Why do you carry three makes if they're all equally good?" Green inquired.

"Come in the stock room and I'll show you," Gus offered. "Now," he said as he pulled three bulky packages off the shelf, "in an automobile you've got heat going to waste in two places. One is out of the exhaust pipe and the other through the fins of the radiator. That means you can heat the car either with hot gases or with hot water. The difference between them is almost the same as steam and hot water in house heating.

"THE steam is much quicker and harder to control to get even heat. Also it's likely to make a 'hot spot' in the car because there's so much heat in such a little space. Hot water heat, either in your home or in your car, is much slower to get going and a lot more steady. Also, the hot water can't get hotter than boiling so there's no possible chance of scorching anything.

"Also," Gus continued, "there's the matter of ventilation. You can't take long trips with every window shut tight without the air in the car getting kind of stuffy. Heating and ventilation are really twin parts of the job of keeping comfortable in winter driving. You've got to figure on one as well as the other.

"Here's a heater that works from the exhaust gases *(Continued on page 147)*

Easily Built SCOOTER

Skims Ice at Mile-a-Minute Clip

By EDWIN T. HAMILTON

IN THESE days of speed, when fast flying airplanes cut the clouds at death-defying velocities, we are apt to look with scorn on anything as slow as seventy miles an hour. And yet this speed will make your hair stand on end if you happen to be seated behind a spread of sail on runners. No windshield, no banked turns, no easy-riding springs, no comforting heat from an engine; just a wild dash on the wings of an icy gale, with but 3 in. between you and the ice!

They are doing just this on the Great South Bay off Long Island. Boys and men from fifteen to seventy-five, all members of the South Bay Scooter Club, which is the only club of its kind, are on the ice right now getting the "kick" of a lifetime. You, too, can have the same sport for a relatively small outlay.

A scooter is primarily a boat that has been fitted with runners for use on ice. Its improvement over the ordinary ice boat and its great safety lie in the fact that it takes to open water quite as readily as to ice. In thirty years of scootering, no one has had a serious accident. Is there any other vehicle in which one can travel seventy miles an hour with safety?

Captain Charles J. Bason, Commodore of the South Bay Scooter Club, to which the writer owes his thanks for the data presented in this article, has beaten some of the fastest of racing ice boats and is now looking for new worlds to conquer. His only complaint is that there are none. At his home in 1924, the first and only scooter club was formed with fifteen members, and today we find a club of close to 300.

Captain Bason displaying a few of his trophies on the deck of his speedy ice scooter.

The growth has been solely due to the fact that this is an inexpensive, safe, and thrilling sport. It has been estimated that a scooter like the one to be described will not cost more than fifty dollars to build. As they are usually sailed by two or three men, why not get a companion to help you and for twenty-five dollars apiece buy yourselves many winters of fine sport?

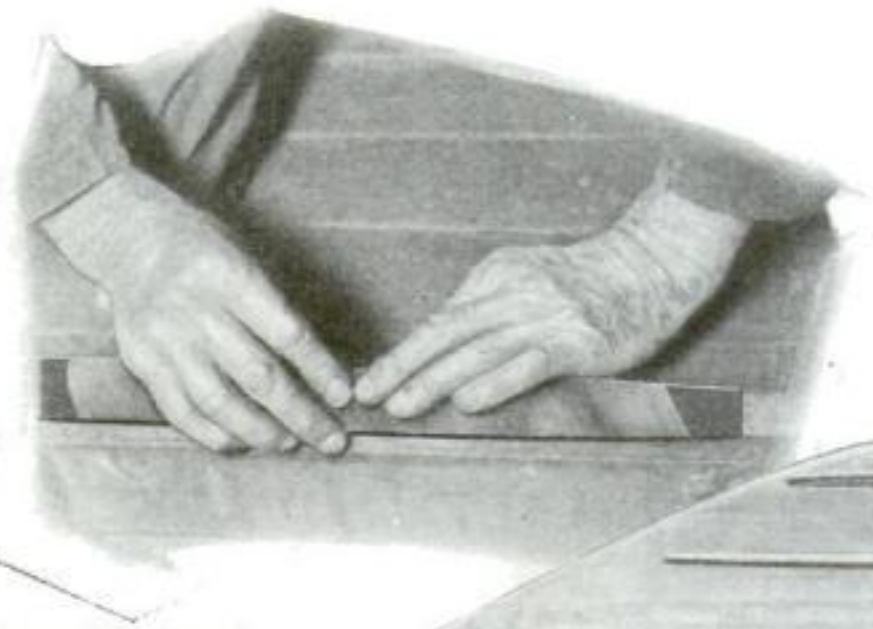
In cross section, the shape of the scooter on both top and bottom, as the drawings indicate, is that of a large arc. The side-to-side bottom ribs have their ends raised 4 in. off level when nailed to the ½ by 3 in. side formers. The side-to-side top ribs drop 3 in. at each end to meet these same side formers. If the shape is studied in the side view, it will be seen that the deck curves downward toward each end, the bow and stern both being 3 in. lower than the highest point amidships. The bottom, conversely, curves up 4 in. at each end.

The top and bottom ribs are cut from oak on a band saw. On stock 1¼ in. thick, 5 ft. long, and as wide as is obtainable, lay out the fifteen necessary bottom formers. Cut them 1¼ in. square and the full

The scooter has no rudder, the steering being done with the jib sail.

length of 5 ft. Remember that the bottom ribs curve up 4 in. at their ends, but the top ribs only 3 in. While only one top and bottom rib of the full 5-ft. length is used, it is found easier to cut the others to the proper lengths after the shape of the boat has been determined.

Obtain a wagon felloe (rim of a wagon wheel), plane it to size, and cut as shown. Then attach two lengths of ½ by 3 in. oak (the side formers) to the joint made in the felloe. The center bottom rib is now nailed between these at a point 6 ft. 6 in. from the outer edge of the felloe.



Above: A file is used to sharpen the angle-iron runners after they are put in place.

Bring the two side formers together 14 ft. from the same point, bevel to fit, and nail them together. A solid oak block is now cut in the triangular form shown and inserted between the side formers at their point of contact; then the side formers are nailed to it with six-penny nails.

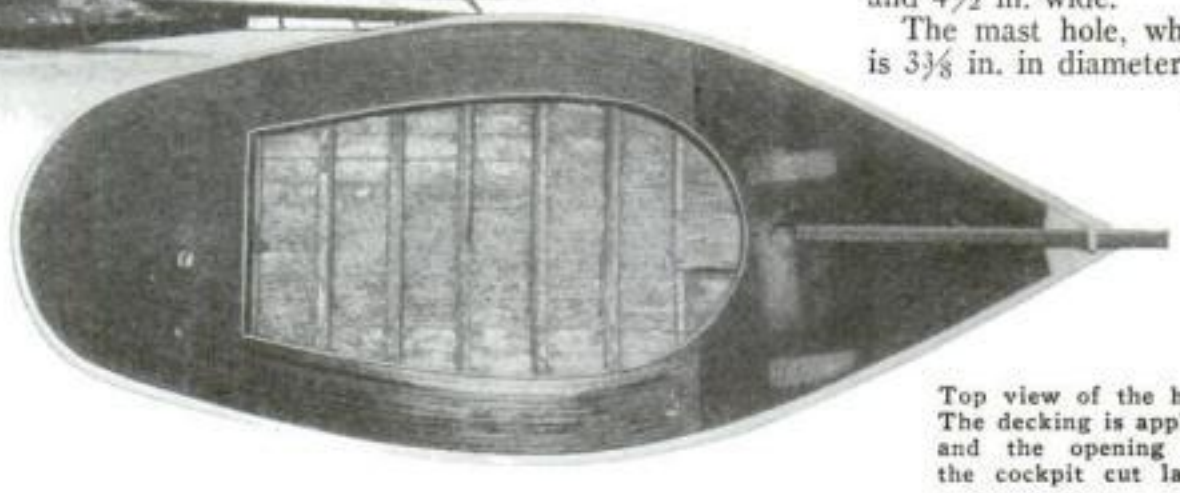
The long bottom fore-and-aft former is now attached. This consists of an oak plank ½ by 3 in. Its length is determined after nailing it to the center of the felloe and bringing it over the center bottom former. It is cut to the proper length for nailing to the bottom edge of the side formers where they meet at the bow. Nail this bottom former to the center bottom rib. Cut two side braces as shown, and assemble the center top rib. A long fore-and-aft top center former is now applied in the same manner as was the bottom former. It is the same size stock although it may be pine, if preferred. When the decking and bottom planking are applied later, these long top and bottom formers become a part of them.

The general form of the boat is now completed. Continue applying the other bottom ribs, and then those for the top. Run the top ribs across the cockpit and cut them after the decking has been applied. The bottom planking should now be nailed in place. It will be found best to start this from the edge and work in, so that a narrow strip, if needed, will not come at the edge.

The decking is ordinarily considered a part of the trim of a boat, but if expense is a consideration, I suggest the use of common pine covered with 8 oz. duck. Both bottom planking and decking should run fore and aft, and should be nailed to all cross ribs.

The top formers are cut to form the cockpit, and the combing is applied. This is constructed of two pieces only. The aft piece, which is straight, is nailed in place on the decking edge; the horseshoe part is steamed, bent, and nailed in the same way. The stock for this is ½ in. thick and 4½ in. wide.

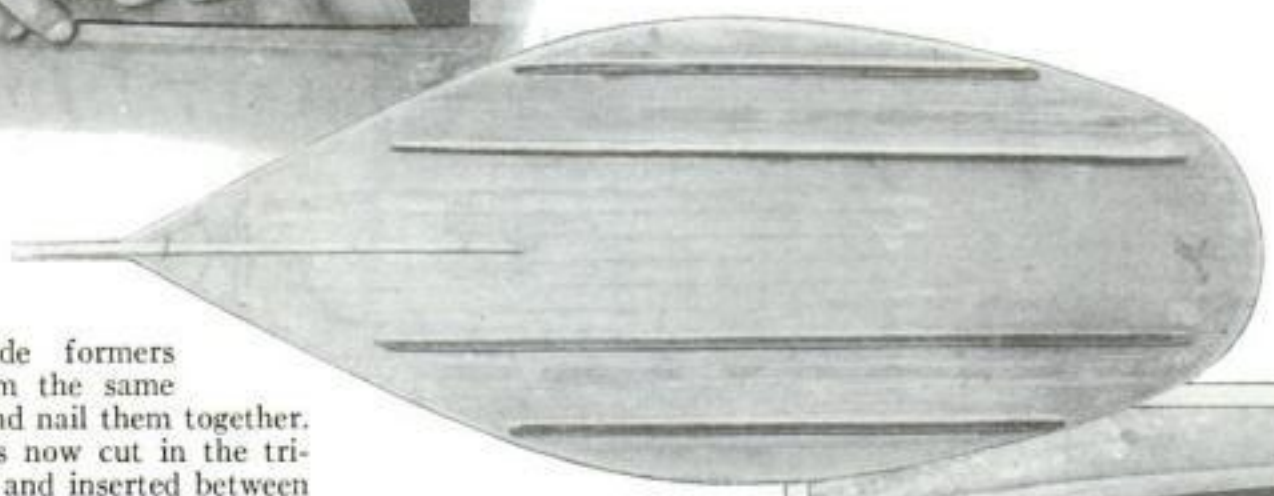
The mast hole, which is 3⅜ in. in diameter, is now located and cut. It is 3 in. ahead of the combing and in the exact center. Next, the step is nailed into place, after a 3⅜-in. hole has been cut into it 1 in. deep. When nailing the step to the cross ribs, make sure that the hole in the deck and the recess in the step are exactly in line. Place a strengthening block of wood between the step and the deck.



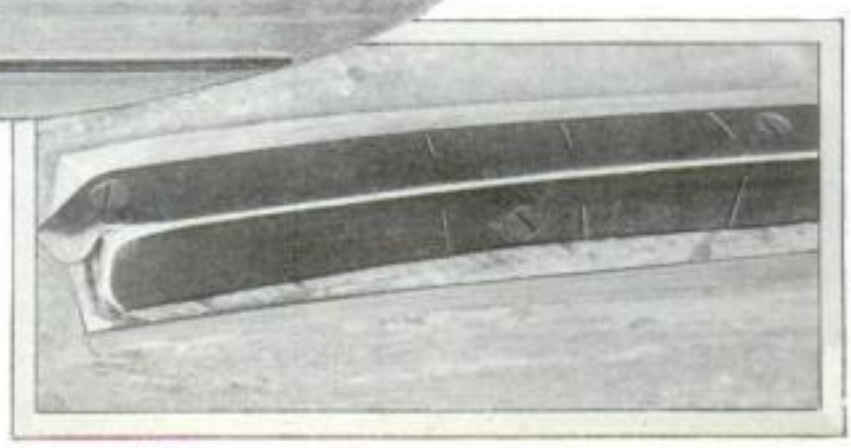
Top view of the hull. The decking is applied and the opening for the cockpit cut later.

The wooden runners are now shaped as shown and attached to the bottom by countersunk bolts through the bottom cross ribs. This is done before the angle-iron runner shoes are prepared. Note that the angle iron must be bent to conform to the runners. They are drilled and countersunk for the 1-in. wood screws which are used to fasten them to the wooden runners.

If pine has been used for the deck, it should be covered with duck. Dampen the duck and nail it over the sides 2 in.; then apply the side trim, which will cover the edges of the cloth. This trim is ½-in. stock 4 in. wide. It extends around the boat over



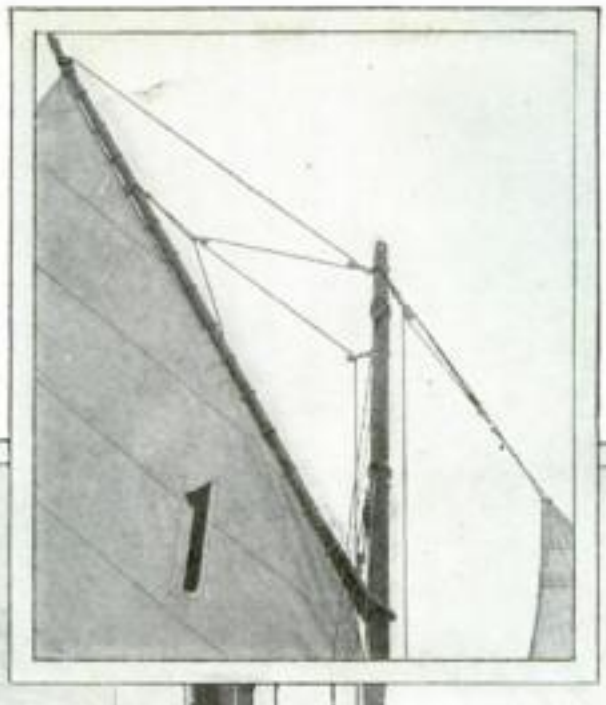
Bottom view of the completed hull showing the planking and four runners.

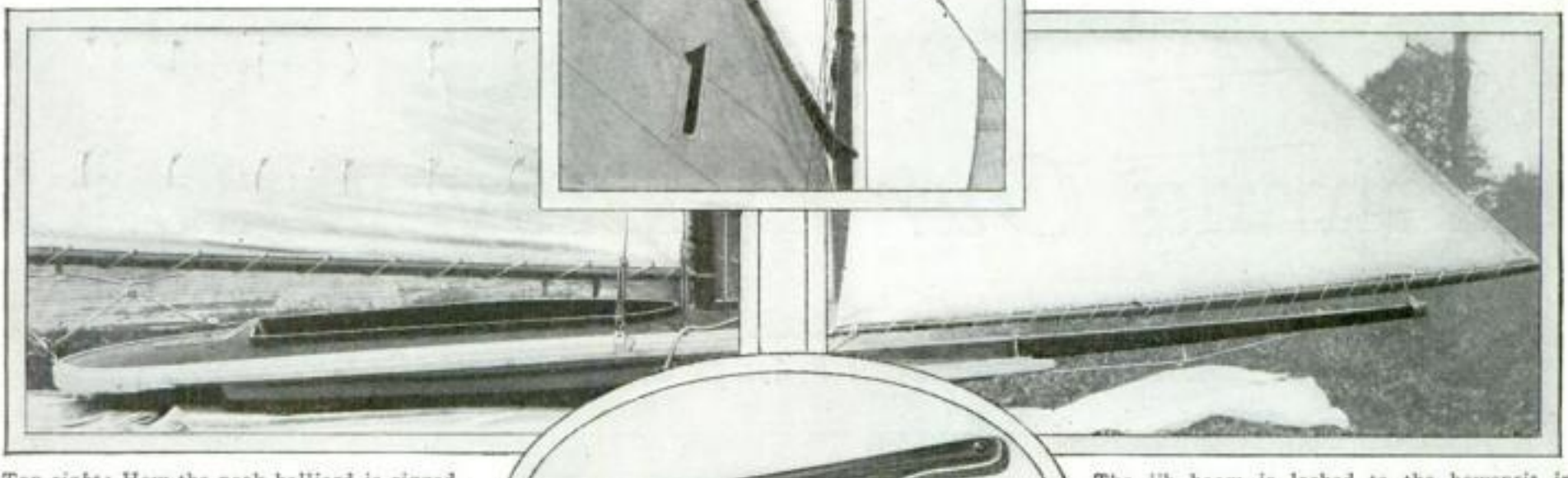


Detail showing one of the runners. The angle-iron shoe is fastened to the wooden runner with screws. The runners are bent to conform to the shape of the bottom.

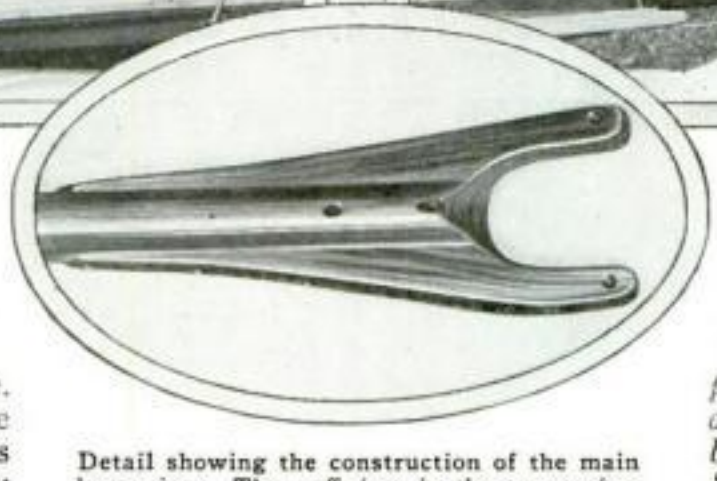
the 3-in. siding and covers the joints between the siding and the top and bottom planking. Over the joint where this trim meets the deck, a ½ in. wide molding is nailed as shown. No calking is required in any of the joints. It is customary to fill the boat with water to cause the wood to swell so that the joints will be water-tight.

All spars are made of either fir or spruce. Great care should be taken to follow the measurements given on the drawings.





Top right: How the peak halliard is rigged. *Above:* The mainsail is laced to the boom.



Detail showing the construction of the main boom jaw. The gaff jaw is the same size.

Attach all necessary cleats to the spars, fasten three cleats to the step, and add the pulleys, chain plates, and necessary rigging as shown. The runners should be filed as sharp as possible at this time.

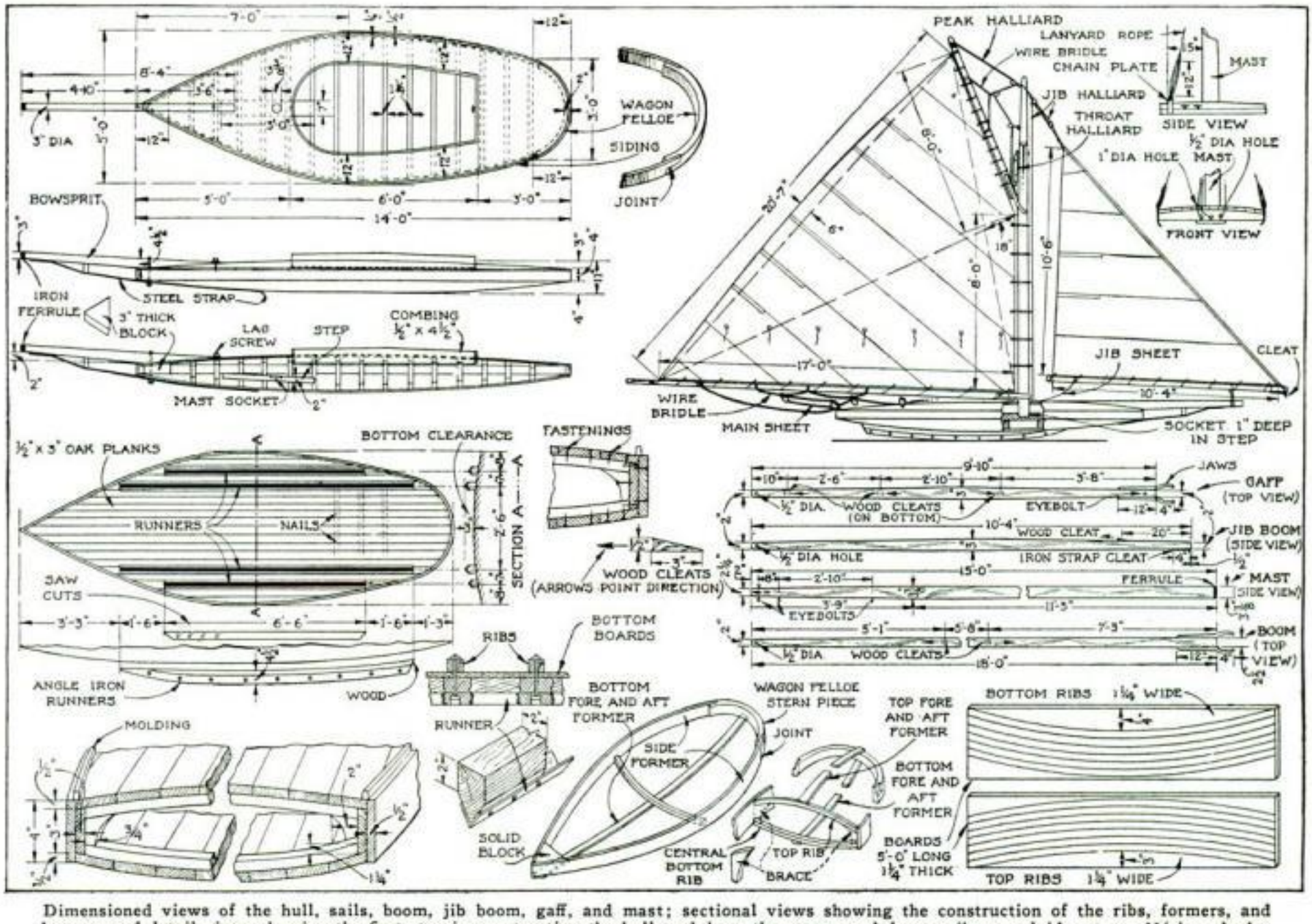
The writer recommends that the sails be ordered from a sailmaker, if the builder is inexperienced in this work, although they can be made of 8-oz. canvas without much difficulty. Note that the scooter has no rudder; the jib serves this purpose. After a few trials, the builder will find this arrangement most efficient.

Paint the boat any color desired, varnish all the spars, and grease the pulleys. Then put on your heavy clothes, hoist your sail, and let 'er go!

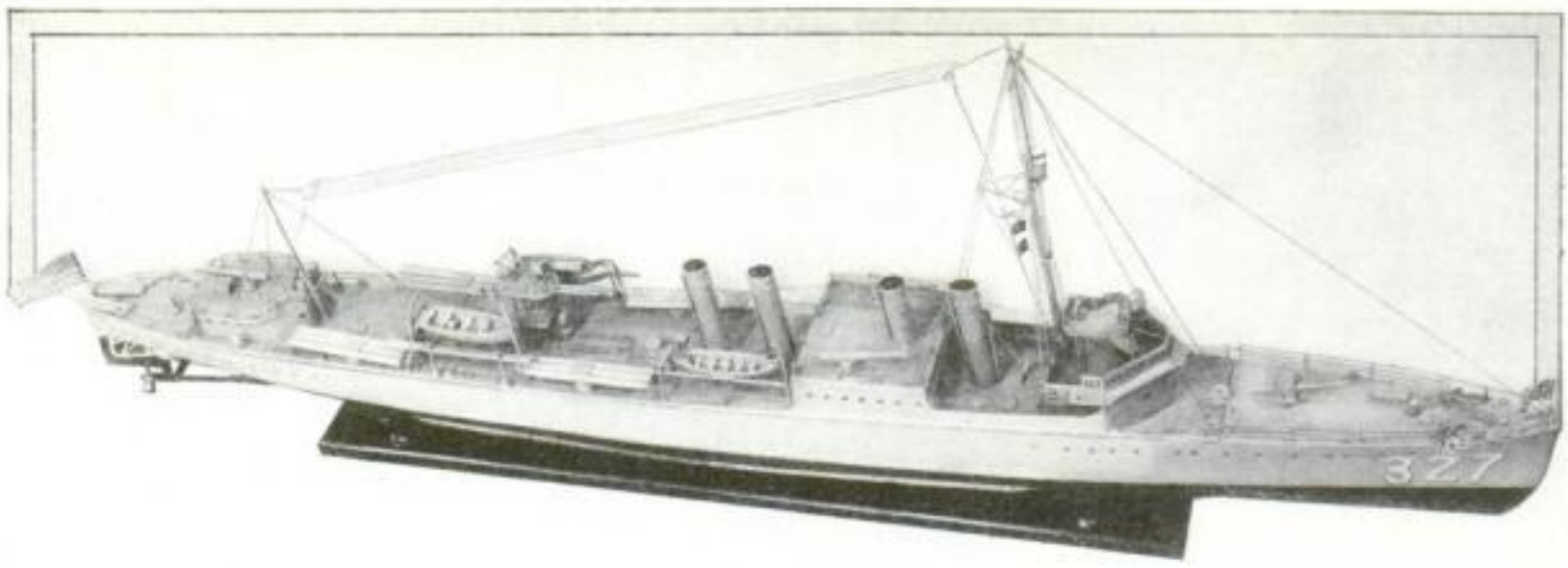
If you have any specific questions to ask concerning this craft, the writer will gladly endeavor to answer them. Address him in care of the Home Workshop Department, POPULAR SCIENCE MONTHLY.

Readers who wish to work from larger plans than those given below may obtain a large blueprint of the original drawings ***by sending fifty cents to the Blueprint Service Department.***

The jib boom is lashed to the bowsprit in such a way as to allow it to pivot easily.



Dimensioned views of the hull, sails, boom, jib boom, gaff, and mast; sectional views showing the construction of the ribs, formers, and braces; and detail views showing the first step in constructing the hull and how the upper and lower ribs are laid out on 1¼-in. planks.



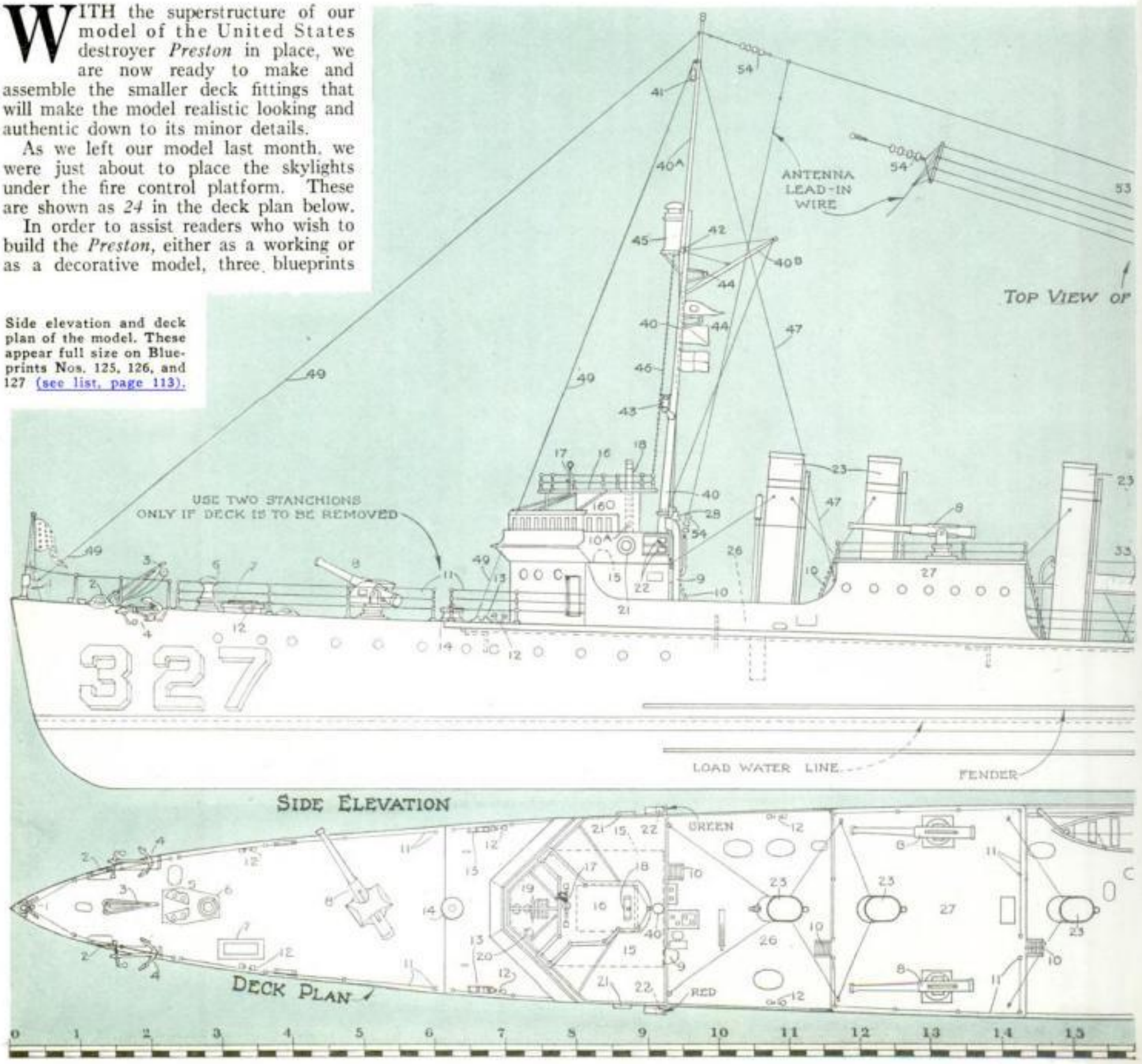
Arming *Our* Destroyer Model

Captain E. Armitage McCann *tells how to construct and place the funnels, guns, and small deck fittings of the U. S. S. "Preston"*

WITH the superstructure of our model of the United States destroyer *Preston* in place, we are now ready to make and assemble the smaller deck fittings that will make the model realistic looking and authentic down to its minor details.

As we left our model last month, we were just about to place the skylights under the fire control platform. These are shown as *24* in the deck plan below.

In order to assist readers who wish to build the *Preston*, either as a working or as a decorative model, three blueprints



Side elevation and deck plan of the model. These appear full size on Blueprints Nos. 125, 126, and 127 (see list, page 113).

have been prepared. These blueprints, which have met with unanimous approval from a large number of model makers, contain full size drawings for a 31½-in. model. They may be obtained by sending seventy-five cents for Blueprints Nos. 125, 126, and 127 (see page 113).

In placing the smaller deck fittings, start at the forward end of the model and work aft. On the stem there is a circular cleat *1* for a towrope. This consists of a section of thin brass tubing soldered to a brass base and having a little socket soldered above it to take the jack staff. This cleat is nailed to the deck with ½-in. bank pins. In this and in all other nailings, be sure to drill small holes first.

At the extreme stern there is another cleat similar to the bow cleat except that the flagstaff socket slopes aft a trifle (see side elevation).

About 1 in. abaft the bow towing cleat are the cleats for the anchor cables, marked *2*. These are loops of wire soldered to plates bent to a right angle as shown.

Between the anchor cable cleats is an oval water-tight scuttle or hatch. Hereafter these small hatches and scuttles will not be mentioned in the text as they are merely small bits of wood or cardboard, placed as indicated on the deck plan. These are manholes, ammunition scuttles, blower trunks, and airlocks. Mine are just pieces of cardboard cut to size and glued, with another smaller piece underneath, to the deck.

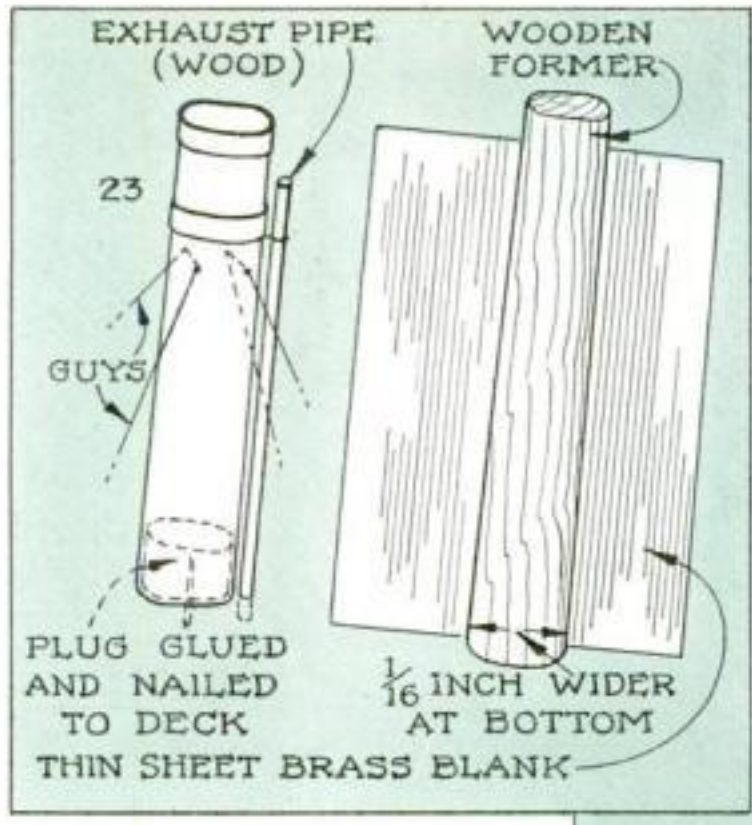
Directly abaft the anchor cable cleats, the deck is cut down at the sides, and small triangular pieces of cardboard are glued on to form the sloping platform *4* for the anchors. The anchors are of the loose stock type and can be made from brass or lead with wire stocks at the ends of which are set small drops of solder. The anchors are fastened down to a slip bar and staples with small chains. I also put a pin staple over mine, which looks like a lashing and serves to hold them in place on the platforms.

On a line with the anchor platforms is the crane for lifting the anchors to the deck. I made this by soldering wires to a sheet metal plate of the right shape as shown at *3*. The blocks are made by soldering a brass disk on each end of a short piece of tubing. A piece of cord should be rove through these to represent the tackle.

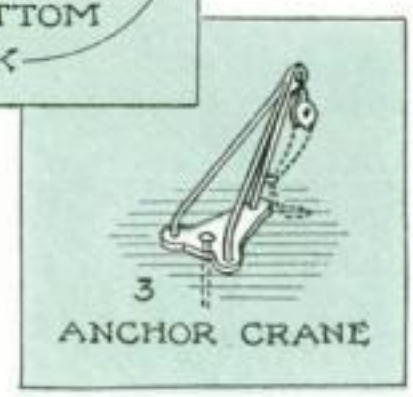
Abaft the crane is an iron plate *5* and the double spurling gates (in reality holes that lead to the chain locker) and the capstan *6*. The lower part of the capstan is a "gypsy" to heave in the anchor cables, and above is an ordinary drum for ropes.

Near by is a hatch *7*, which, in reality, can be sealed down or partly raised in order to form a companionway.

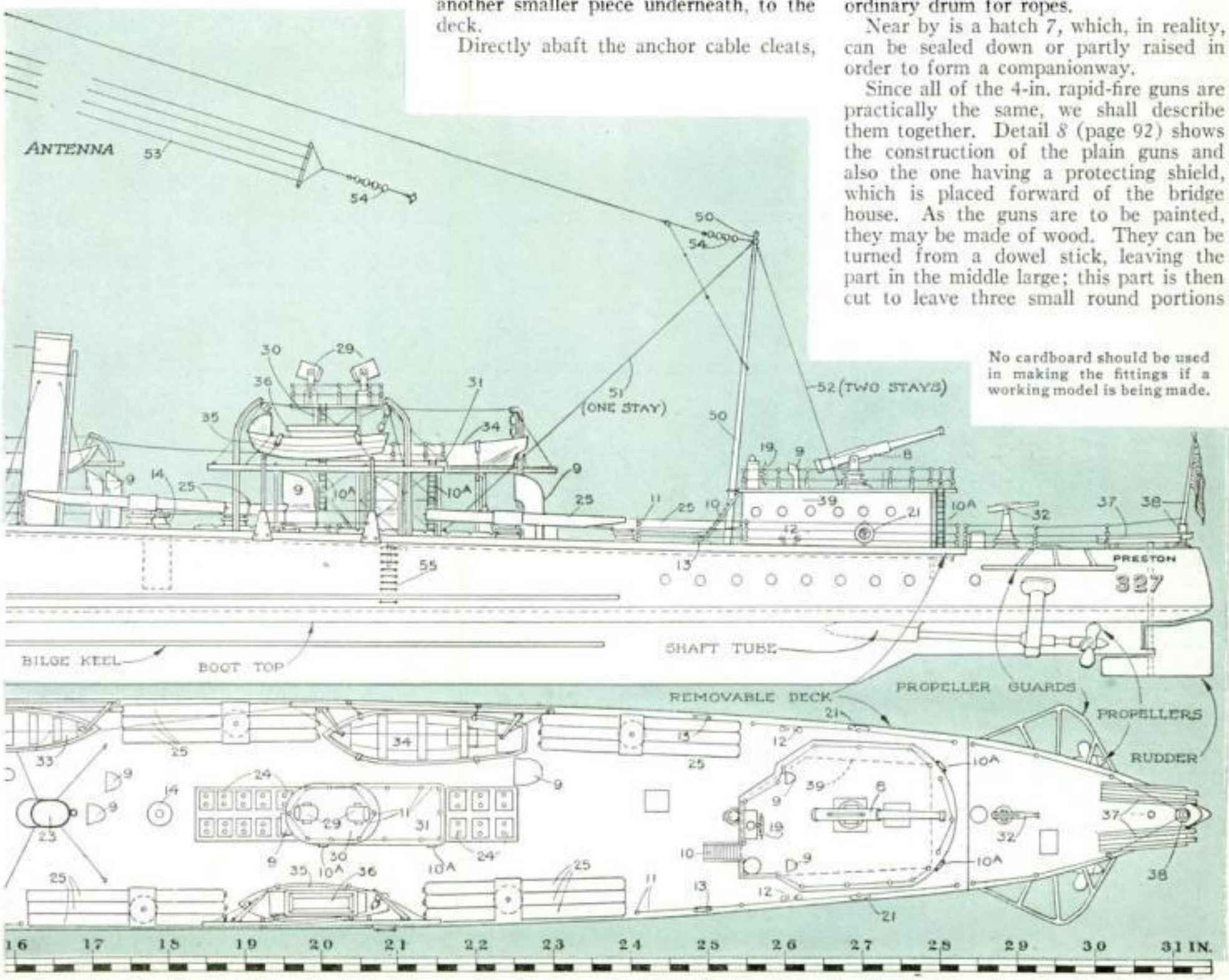
Since all of the 4-in. rapid-fire guns are practically the same, we shall describe them together. Detail *8* (page 92) shows the construction of the plain guns and also the one having a protecting shield, which is placed forward of the bridge house. As the guns are to be painted, they may be made of wood. They can be turned from a dowel stick, leaving the part in the middle large; this part is then cut to leave three small round portions



A wooden former is used in constructing the funnels. *Right:* The anchor crane can be made from sheet metal and wire.



No cardboard should be used in making the fittings if a working model is being made.



to represent the two recoil cylinders underneath and the sighting tube on top. If preferred, the guns can be turned to shape and these small details glued in place later. The bases also can be turned. The square part of the base is a piece of cardboard glued to the deck. To mount the guns, a hole is bored up into the base and a pin shank is inserted; this is then driven into the deck.

The forward gun requires a shield. Metal is the best for this, but cardboard will serve. This should be bent to shape and glued to the gun mounting before the gun is placed.

In the well deck, there is a lift-up skylight and a small hatch. These are shown in the detail of the well deck.

A ventilator, fan, and motor are also placed in the well deck as shown. The ventilator should stand high enough to allow its cowl to extend over the end of the bridge rail.

Four wide sloping ladders *10* and five narrow upright ones *10A* are required. The sloping ladders in reality are flat iron plates about 5 in. wide, slightly bulbed on both edges and with two iron bars riveted to them for each step. After several failures to make these on so small a scale, I hit on the following method which is easy and neat: I flattened some No. 22 wire slightly, tinned it with solder, clamped two pieces parallel in a small hand vise, and placed this in such a way in a large bench vise that the wires were horizontal. After soldering two pieces of smaller diameter wire together and cutting them into lengths equal to the width of the ladders, I spaced these evenly along the length of the two uprights and soldered or "sweated" them in place, using a lighted candle for the heat. The ladders can be secured by inserting the lower ends of the uprights in holes bored in the deck and placing staples at the upper ends.

The upright ladders, which are narrower and have only one bar to a step, can be made in a similar manner.

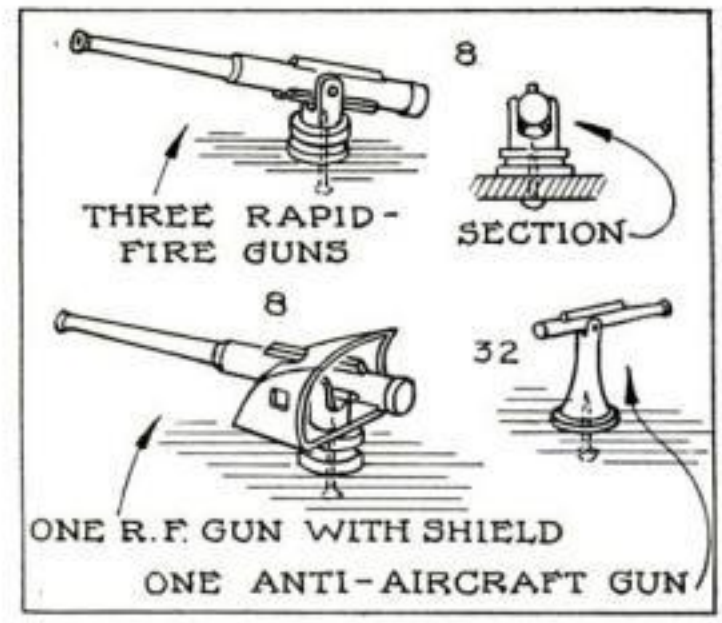
The four funnels *23* are best made from shim (very thin) brass. First, trim a stick to the inside shape of the funnels, making it a trifle larger in diameter at the lower end; this will allow the funnels to slip off after they are shaped. Cut a piece of the sheet brass a little longer than the funnel and about 3/16 in. wider than is actually required to reach all the way around the wooden former. File one edge of this to a bevel, tin the outside of this edge and the inside of the other, wrap the metal around the former, and tie it with thread. The two edges are then soldered, and the outer edge of the flap is filed flush with the sides. A ring cut from the bottom edge, about 1/16 in. wide can be soldered to the top of each funnel for appearance and stiffening. Eyebolts for the guys may be soldered on, but I punched holes in the funnels and threaded the guys through with a needle.

When all the funnels are made, cut ¼ in. long sections from the stick at the correct angle, and glue them in the funnels flush with the bottom; then glue and nail the whole to the deck. Note that the funnel which comes through the galley need not be as long as the rest. Be careful to see that the funnels are along the center line of the ship and that their tops are all in the same horizontal line.

On the fore side of the first funnel is the whistle, which can be a thin, round stick inserted in a short piece of brass tubing. The exhaust pipes are sticks inserted in the deck and tied to the funnels with thread. A knot placed between the sticks and the funnels will cause them to stand apart.

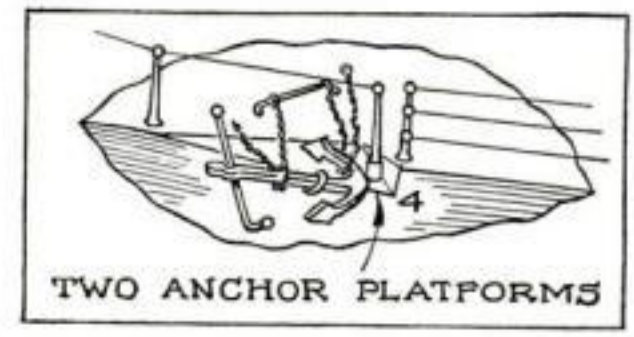
If the model is being built to a scale one and one half times as large as that given on the blueprints, it must be remembered that each deck fitting must be made correspondingly larger than shown.

Next month we shall describe the rest of the details and apply the finishing touches to our model.

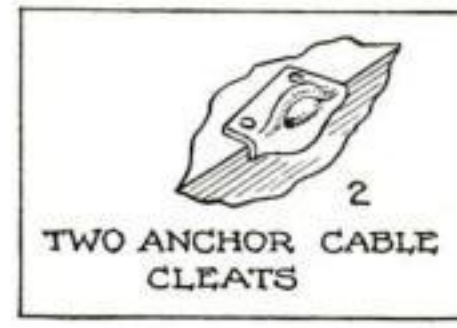


The guns required on the model. The shield for the forward gun can be of cardboard or metal as desired.

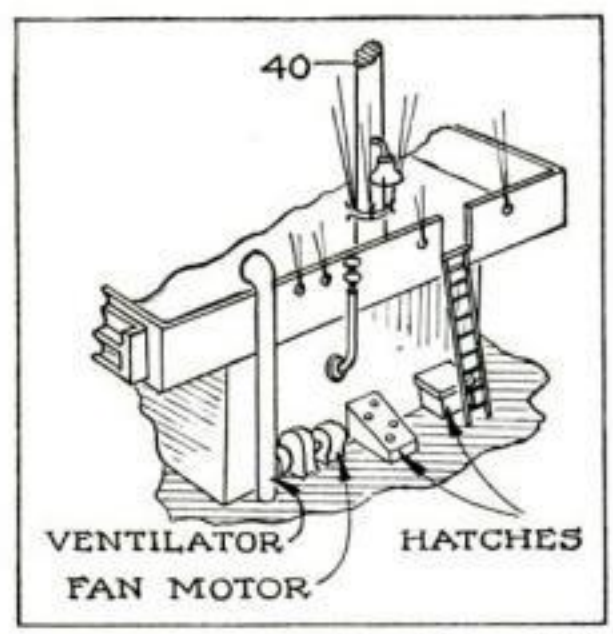
Few tools are needed in constructing the funnels and smaller deck fittings.



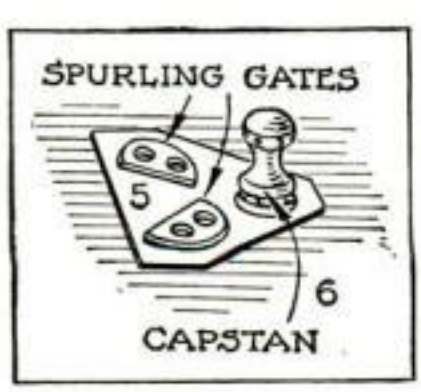
The anchor platforms are placed abaft the anchor cable cleats. The anchors can be either lead or brass.

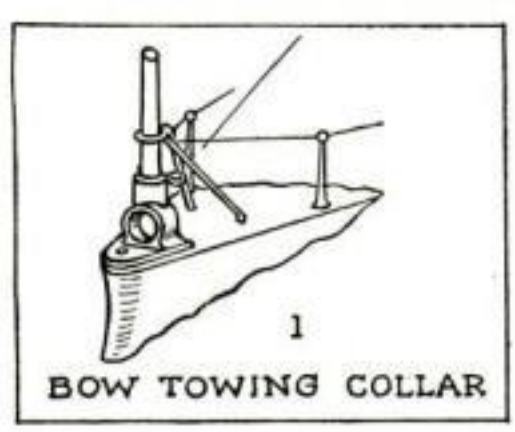


Detail of the stern towing collar and flagstaff socket *(38)*. The anchor cable cleats *(2)* are made by soldering a loop of wire to a metal plate.



A ventilator, with its fan and motor, and two hatches are placed in the well deck against the after end of the bridge house.





The spurling gates *(5)* and the capstan *(6)* are placed just abaft the crane. Detail showing the construction of the bow towing collar *(1)*.

SMALL diameter holes can be made in sheet glass by placing a piece of putty on the glass, forming a hole in the putty of the desired diameter down to the glass, and pouring molten lead into the well thus prepared. When the hot metal hits the glass, it will crack out a piece equal approximately to the diameter of the well. Be sure that the wall of putty is substantial enough to retain the molten lead.

The latest novelty in party decorations—

An Illuminated Ice Mountain

By

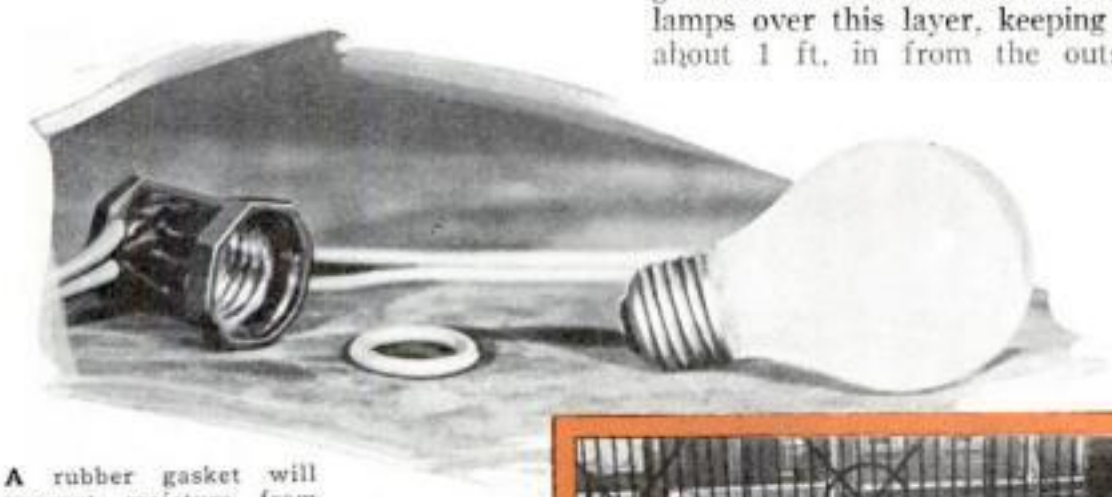
VERNON B. CASE

A novel lawn decoration for the winter months.

ONE of the most unusual and brilliant sights enjoyed by guests of the Lake Placid Club, in the heart of the Adirondacks, last winter, was a huge pile of broken ice. 10 ft. high and 20 ft. in diameter and weighing approximately 20 tons, beneath which glowed and flashed dozens of colored electric lamps. Every imaginable color was produced by the prismatic action of the ice.

In carrying out preliminary experimental work, L. C. Porter, who is a member of the engineering department of one of the largest electric companies, found that anyone may enjoy an illuminated ice mountain. Such a decoration may be placed on the lawn in winter or used for adding color and novelty to a summer garden party. Its cost is surprisingly low, the necessary electrical equipment being used over and over, and the only perishable part, the ice, being inexpensive. Three or four 300-lb. cakes of ice, costing 75 cents each in most cities, will suffice for a fair-sized pile. It will last at least one evening, even in hot weather, and in winter it may be expected to remain attractive for almost a week.

In building an ice mountain, first obtain a 100-ft. decorative streamer with lamp sockets spaced 2 ft. apart. In selecting this, obtain sockets that are as deep as possible, so there will be room for a flasher button beneath the lamp base.



A rubber gasket will prevent moisture from getting into the socket.

Insert such a button—a slow-flashing one is best—into three sockets out of every four. Place a soft rubber gasket about each lamp base, and screw the lamp into the socket. The gasket is necessary to prevent water from getting into the socket. Equip each lamp with a wire guard to prevent its being crushed by the weight of the ice.

Of course, all of the sockets in a 100-ft. streamer need not be used, or a shorter string may be employed. As to the lamps themselves, Mr. Porter found that alternate red, blue, green, amber, and yellow lamps gave the best results. Yellow and amber lamps that burn steadily should be of the 10-watt size; the others of the 25-watt variety. By having some lamps burn continuously while others flash, a smoother action is obtained.

Next, break the ice into pieces about 1 ft. in diameter and pile a layer on the ground. Then distribute some of the lamps over this layer, keeping the bulbs about 1 ft. in from the outside edge.

The lamps should be distributed evenly throughout the pile of ice. Wire guards protect the bulbs from being crushed.

Pile on another layer, arrange more lamps, and continue until the ice mountain has been completed. You are then ready to put into action a light jewel that must be seen to be appreciated.

The ice, of course, will decrease in volume. Pieces can be added to compensate for that lost, but eventually the lamps will all sink to the bottom of the pile, and the effect will not be satisfactory. The heat from the bulbs does not contribute much to the melting action, it was found. In the daytime, if a blanket is spread over the pile, melting will be retarded.

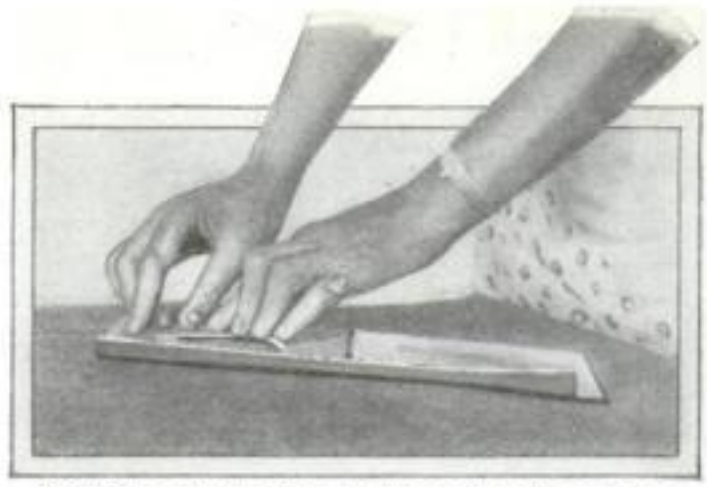
The lighted ice pile for the lawn suggests another little stunt: Fill a large dish with cracked ice, bury in it a number of radio dial light bulbs or flashlight lamps carried in suitable sockets that are wired in parallel, and you have a centerpiece of unsurpassed beauty for the table.

If flashlight lamps are used, they can be operated from a number of dry cells giving the proper voltage. For the No. 1 mazda flashlight bulb, 2.5 volts are required, so that two dry cells in series will serve; or a single storage battery cell may be used. If radio dial lamps are employed, they can be operated from a 6-volt radio or bell transformer, or a 6-volt storage battery. Either type of lamp will fit small radio lamp sockets or the miniature "pig-tail" sockets obtainable from electrical stores. A half dozen lamps will be sufficient.

Still another attraction worked out by Mr. Porter and other engineers at Lake Placid was a star, outlined with lamps frozen in the ice of the skating rink.

Making a Photo Frame *in Leather*

By F. CLARKE HUGHES

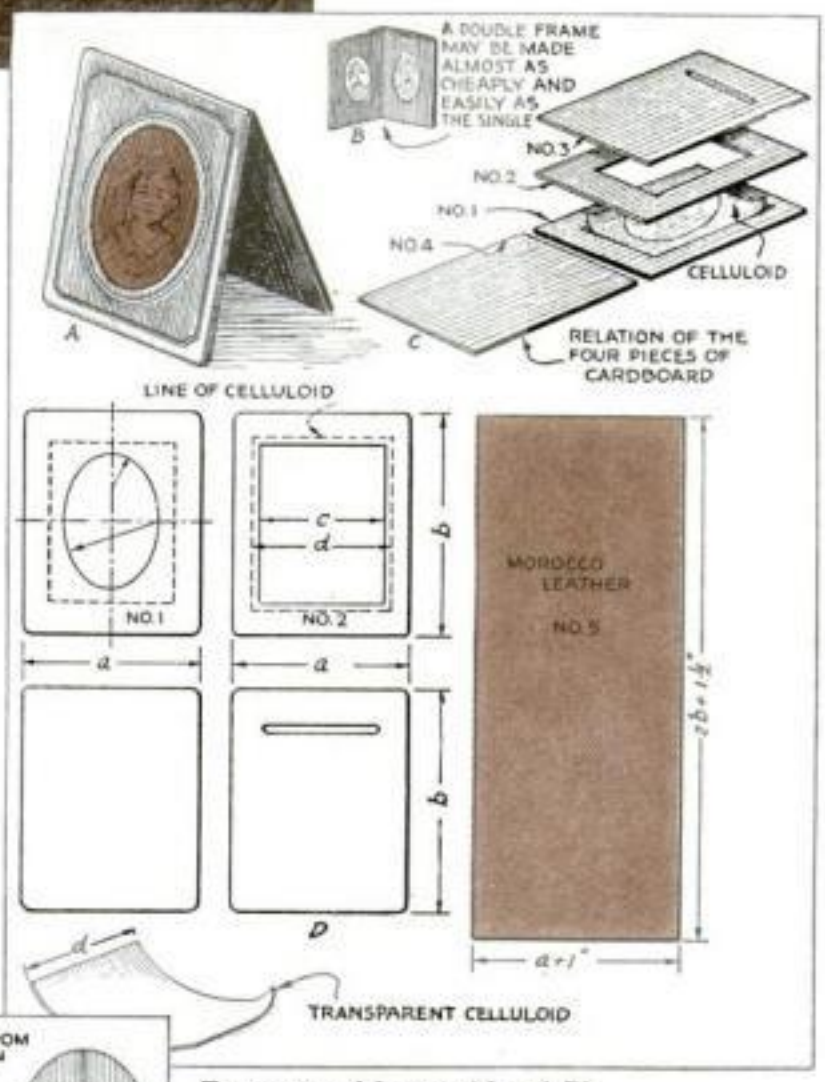


Mounting the leather on the cardboard sections Nos. 1 and 4. The leather is notched and folded back over the edge of the oval (see drawing *G*).

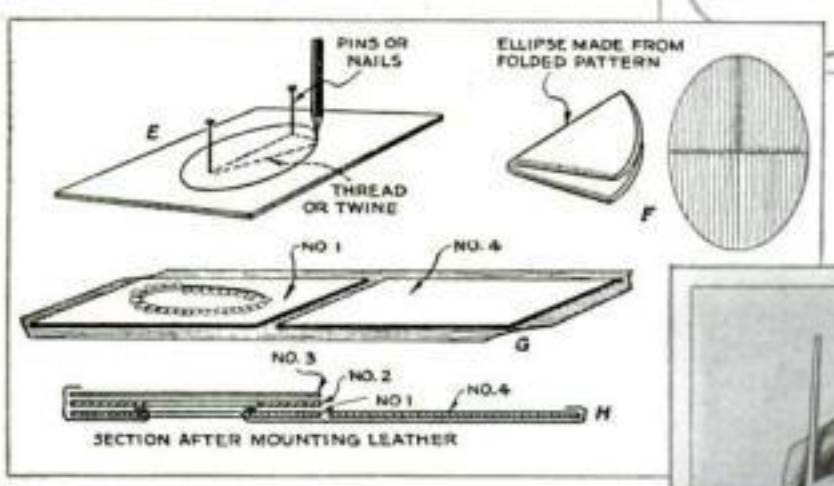
THOSE readers of POPULAR SCIENCE MONTHLY who have been following this series of articles on decorative leather work will find that the photograph frame illustrated, while a little more difficult to construct than some of the other projects, is one of the most attractive designs. It is a piece that you will want to keep yourself as well as one that makes a universally acceptable and highly prized gift.

The frame should be constructed of tough cardboard which will bend without breaking; it should be about 1/16 in. thick. At a printer's or bookbinder's one may obtain a special grade of bookbinding board which serves this purpose adequately. Morocco leather should be used as the facing or covering. It usually may be purchased at a bookbinder's or at any well-stocked leather shop.

The first thing is to determine the shape and size of the picture frame and to cut the patterns. The two types given at *A* and *B* can be folded up; however, *A* also may be made with a simple metal or leather covered easel for the back instead of the folding support shown.



Two types of frames (*A* and *B*), relative positions of the cardboard sections (*C*), and layouts of the cardboard and leather (*D*).

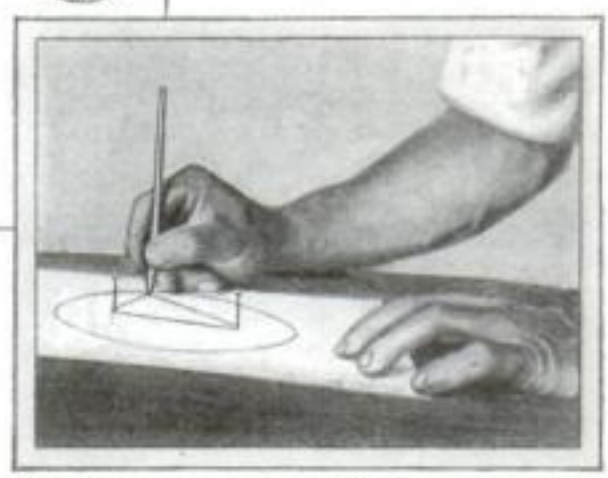


Two methods of obtaining an ellipse (*E* and *F*), and how the leather is mounted (*G* and *H*).

The sections of cardboard are shown at *C*, all cut and shaped for making a frame similar to type *A*. These sections are of the sizes shown in the dimensioned drawings *D*.

Cut two pieces of leather, one for the back exactly the size of part No. 5 (shown at *D*) and the other, which is for the face, sufficiently larger so that it can be lapped around the edge and over the back for about 1/4 in.

Next, shape and cut the several cardboard sections forming the body of the frame. The oval in section No. 1 may be laid out by either of the two methods shown at *E* and *F*. In method *E* is shown the more familiar plan, that of using two pins or nails and a piece of thread or twine to produce a true ellipse, while *F* shows a way to fold and cut a paper pattern for an approximate oval.



Laying out an ellipse with the aid of two pins, a piece of string, and a lead pencil.

The oval in part No. 1, the square in No. 2, and the small slit in No. 3 may be cut with an ordinary knife, but smooth the edges with a bit of sandpaper. A sheet of transparent celluloid is cemented over the opening in part No. 2 as illustrated at *D*.

Sections Nos. 1 and 4 should be coated with rubber cement on one side. If the cement is spread with a small piece of cardboard, an even layer may be obtained. When the cement has become quite "tacky," these sections (Nos. 1 and 4) should be placed on the rough side of the larger piece of leather as shown at *G* and rubbed with the tips of the fingers until smooth.

With a sharp knife cut the leather around the oval in the form of a series of flaps as indicated, and cement them down. The outside edges of the leather, however, should not be cemented until the other sections are put into place as shown in the sectional drawing *H*. No cement should be used between any of these parts, but when the pieces are all in place, the morocco should be turned over the edges and cemented to the back. The cutting and mitering of the corners as at *G* will be found an undertaking that requires some careful fitting; it should be done as the work progresses, rather than before you begin to turn up the edges. A good plan would be to experiment with a piece of paper before using the leather.

When this main section or face side is mounted and the edges have been turned, the back piece should be trimmed to a size that will leave a space of about 1/16 in. between its edge and the edge of the frame. In mounting this thin morocco, be very careful not to apply the cement so thickly that it will show through the material on the face side, thereby causing an unsightly stain. This is a common defect in the work of beginners.

After the leather is mounted and the cement dry, it may be tooled quite easily as at *J*, page 96. Merely dampen the face a trifle and outline the design with the point of a lead pencil. If a simple vein is to be used, the same methods as have been described in former articles may be followed; however, if the reader cares to

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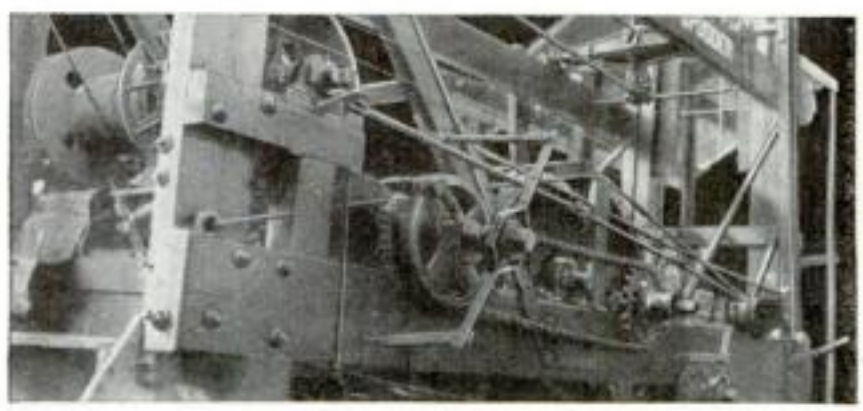

One of the many SKF equipped machines in the petroleum industry . . . The Wichita Falls Spudder . . . used for drilling to 4000 feet . . . made by Clark Machine Company, Wichita Falls, Texas.

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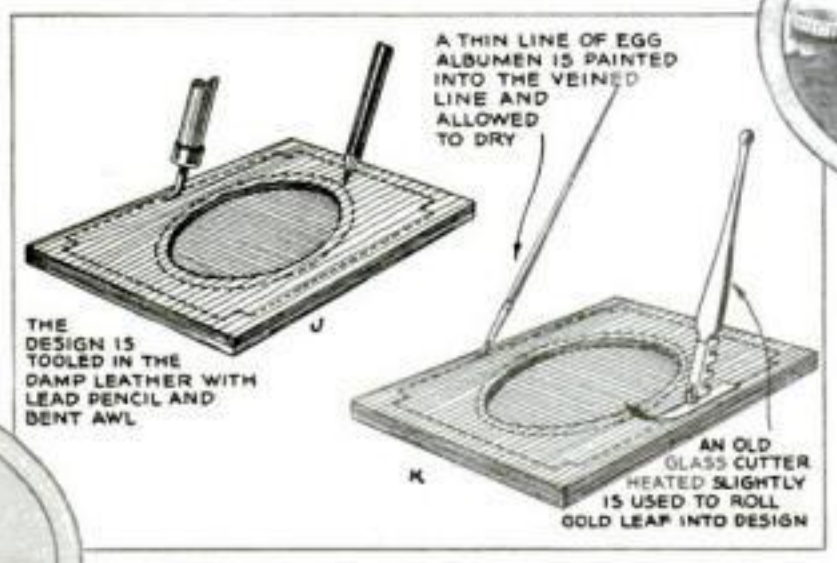
finish the picture frame with a genuine gold leaf line, it may be done without too much extra work by the following method.

Gold leaf may be obtained in small quantities from a bookbinder or a local sign painter, and it may sometimes be purchased in single sheets from the paint dealer. Being exceedingly thin and fragile, it must be kept between the leaves of a book or two sheets of thin paper until ready to use and be handled on the side of a fine flat brush—a special brush is made for the purpose—when placing it in position on the design.

The lines you wish to gild should be coated with a wash of albumen sizing made from the white of an egg beaten to a froth and allowed to stand overnight. Apply the size with the tip of a small brush as shown at *K*. Allow it to dry overnight. While a sizing of flour and water is sometimes used for laying gold leaf on leather, it is not as satisfactory as albumen. When you are ready to lay the gold, oil the sized line lightly with a little vaseline and place a narrow strip of the gold leaf in position. The vaseline will retain the leaf temporarily in position while the heating and rolling is being done.

Rolling gold leaf into the tooled design.



The design is first tooled on the leather *(J)*; then the albumen size and the gold leaf are applied *(K)*.

If regular rollers for laying gold leaf are not at hand, several old glass cutters may be used if the temper is drawn from the wheels and the edge dulled somewhat. These should be kept heated to the temperature of about an ordinary flat iron.

Applying the albumen size to the design with the tip of a small brush.

The best way to do this is to place them in a pan of sand, which may be heated over any kind of a fire. The hot tools serve to melt the albumen sizing and causes the gold leaf to adhere to the leather.

This method of illuminating the designs on book covers and other leather articles is very old, and some of the old books have retained their valuable decorations for centuries. The depth of the tooled design protects the gold leaf from most of the wear incident to everyday handling.

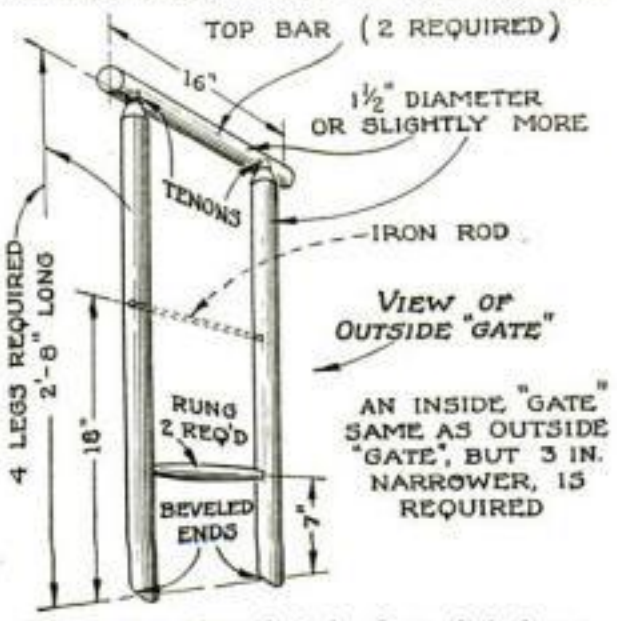
Your Guests Will Like This Luggage Rack

This luggage holder can also be used in the dining room or sick room to hold a tray.

THIS useful luggage rack not only saves the bed and the floor when your guest packs or unpacks a suit case, but it will also hold a tray in the dining room or sick room. Although usually priced at from $7 to $8, this particular rack can be constructed at home from wooden curtain poles or other round rods 1½ in. or a trifle more in diameter. A good height is 27 in. with a 16 by 18 in. spread for the top.

Cut two legs 2 ft. 8 in. long and dowel them into a top round that is 16 in. long—close to its ends. Connect the legs by a small rung set 7 in. up from the bottom. This completes one "gate."

Construct another "gate" exactly like the first in height, but make it 3 in. narrower by setting each leg 1½ in., or its own diameter, farther in from the ends of the top round. This allows one gate to stand inside the other. Fasten them together 18 in. up from the bottom by inserting a small iron rod through the legs where they cross to act as a pivot.



Two gates, pivoted 18 in. from their lower ends, form this easily built luggage rack.

Connect the two top bars with upholsterer's webbing, or strong tape, in colors; the longer the strips the lower the rack will stand. Then cut off the feet of the rack at an angle to fit the floor, and insert polished steel gliders or glue on disks of felt.

Lacquer the rack any desired color, using a black trim for the iron rod and the ends of the top rounds.—A. May Holaday.

PLANKING SHIP MODELS BY AN EASY METHOD

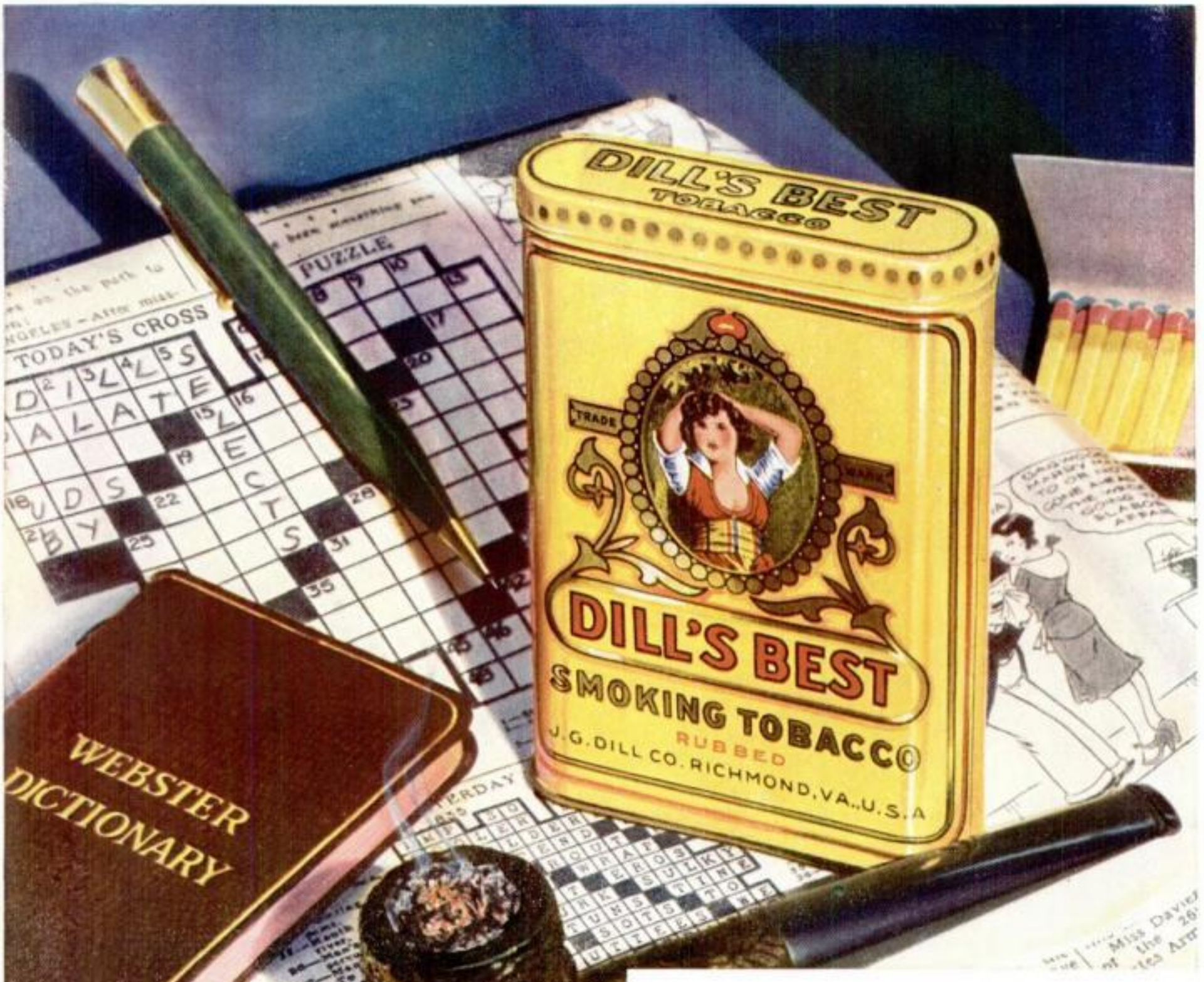
ALTHOUGH a planked ship model is much more realistic than an ordinary carved model, a built-up hull is so difficult to construct that few model makers attempt it. With a little patience, however, an attractive, full-planked appearance may be produced easily by the following method.

The hull is first carved in the usual manner. Then obtain a Japanese wall pocket, which can be bought at almost any variety or notion store; this consists of strips about 1/64 in. thick and 1/8 in. wide, which is the right size to represent planks on a model of ordinary proportions.

The strips are glued and tacked with very small pins to the carved hull. Because of the difference in girth at various points along the hull, it is necessary to taper the planks where they approach the stem and the sternpost, especially on those close to the keel. Around the stern, it may be necessary to soak the strips in hot water for several hours to make them pliable enough to follow the curves of the hull.

For modern steel ship models, pieces of drawing paper cut to represent steel plates may be "riveted" to the hull by means of small pins.—Roger Schell.

Realistic planked effects on ship model hulls can be obtained with strips of thin veneer.



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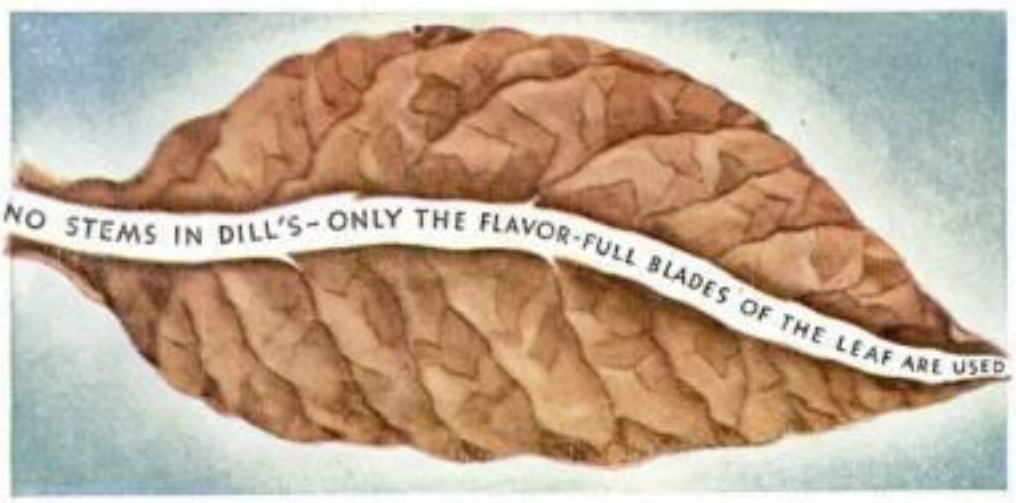

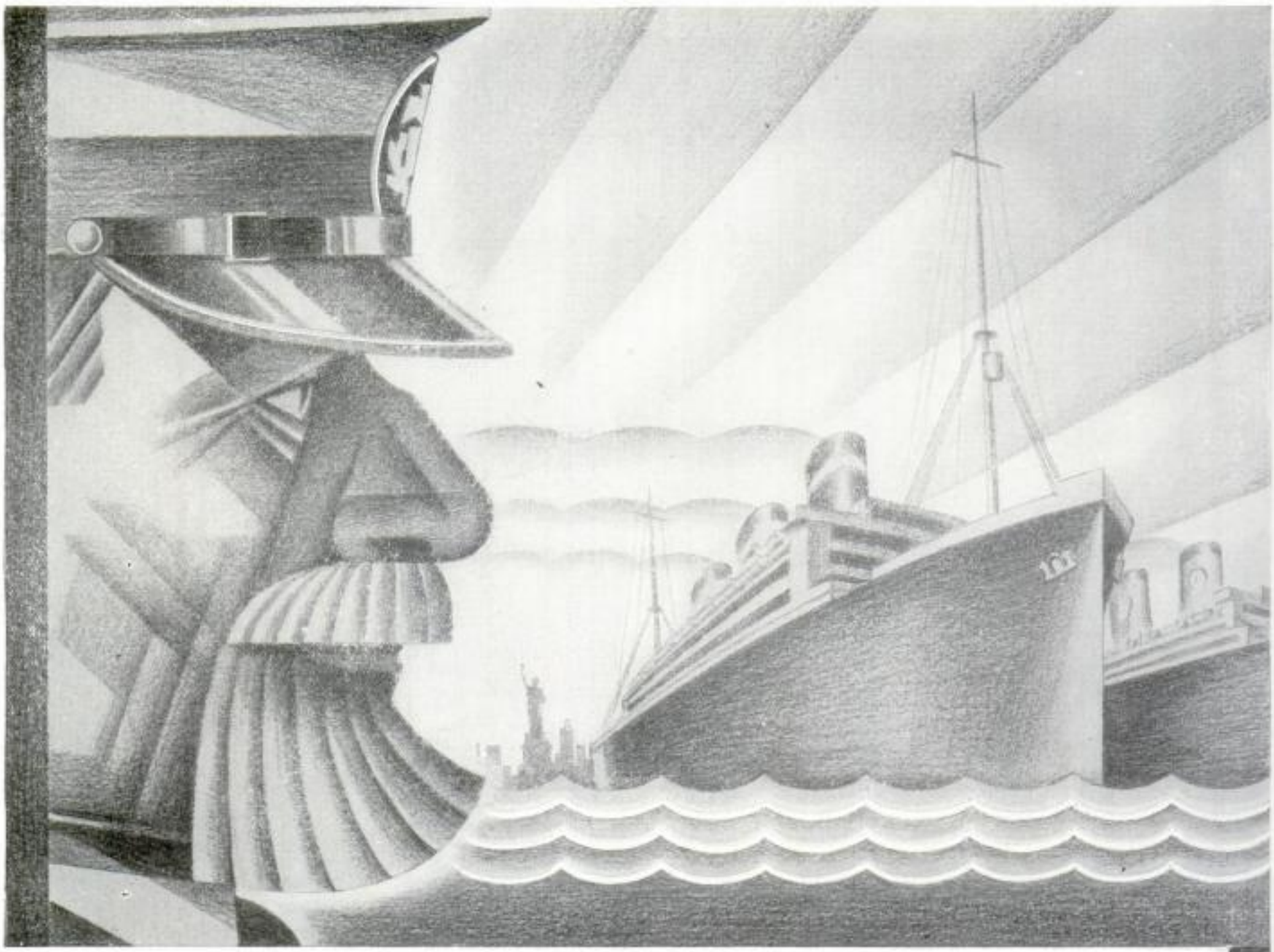

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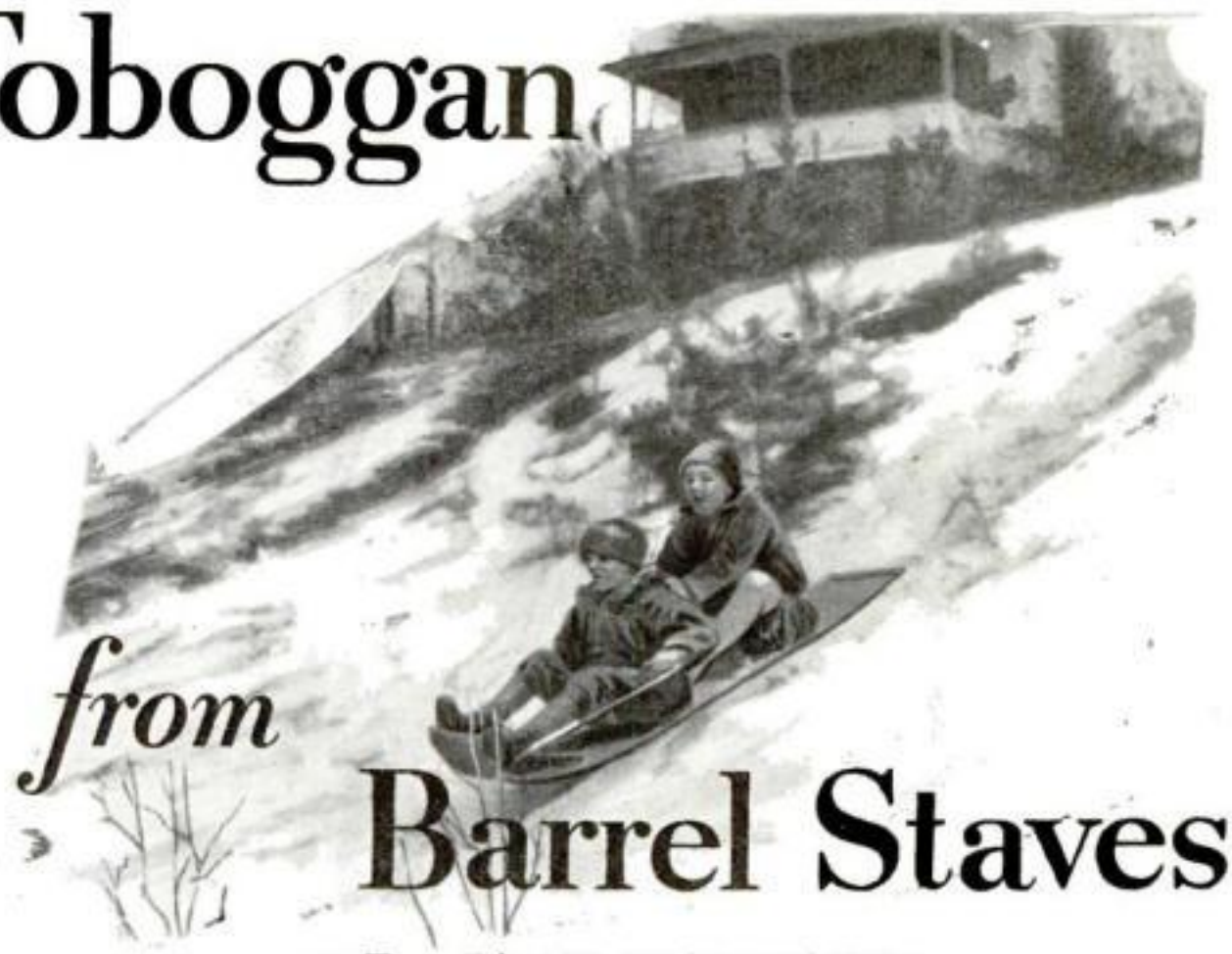
Speedy Toboggan from Barrel Staves



Besides being a source of endless fun on the hills, this sturdy little snow coaster can be used on hikes and hunting and camping expeditions. It's easy to construct, and as for expense—practically all the parts can be obtained for next to nothing.

By JACK HAZZARD

BUILDING this barrel-stave toboggan is just the kind of a job in which a "hammer and saw" youth glories. He is certain to make a success of it even though his product may look somewhat rough and ready. The resulting toboggan, while not recommended for coasting on extremely high, steep grades, serves admirably for smaller slopes, especially when there is plenty of snow. It is fast, makes an excellent conveyance for use on winter hikes or trapping or camping expeditions, and is light in weight.

From your grocer obtain a large barrel having little curve to the staves—a potato barrel of the rougher type is just about right. Sharply curved staves should be avoided as they make the toboggan too rocker-bottomed.

After taking the barrel apart carefully, plane away the bulge along the middle portion of the staves, making them into parallel-sided boards. Three or four of these side by side will provide a section 15 in. wide by 28 in. long. Nail a batten across the middle of the section, driving the nails through the batten and clinching them smoothly on the underside of the staves. Another batten is nailed at the end of the section, which will be the tail of the toboggan, the tail section being made first.

Its flexibility allows the toboggan to take the bumps easily.

Now make another section like the first, with a batten across the center. Nail and clinch it firmly to the front end of the first section made, allowing a lap of from 11 to 15 in. A batten is nailed over the center of the lap. The addition of two more of these sections will provide ample length.

The curved prow may be made in one of two ways: short lengths of barrel hoop may be nailed to a batten and then lapped and nailed from 4 to 5 in. under the front of the toboggan, or a piece of a wooden cheese box may be nailed in place and reënforced with battens. If hoops are used, the inside of the lapping ends should be beveled to prevent too prominent a lump at this point.

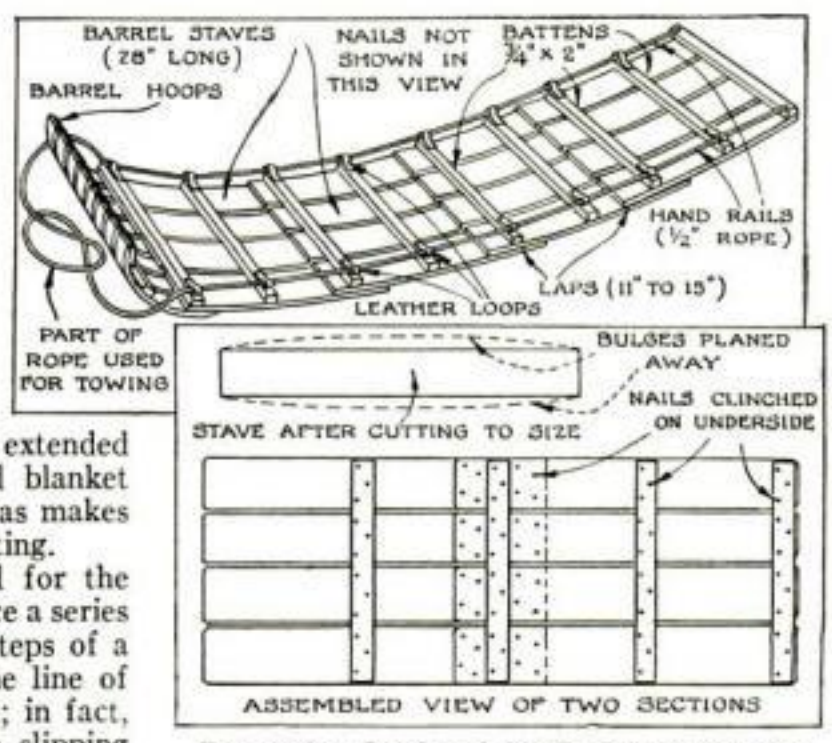
At each end of each batten is nailed a loop of leather through which is rove a ½-in. rope to serve as a handrail and for use when lashing on a load. The ends of this rope may be extended to act as a towline. An old blanket folded and covered with canvas makes a good pad for use when coasting.

Of course, the staves used for the bottom of the toboggan produce a series of steps, but these, like the steps of a hydroplane, do not oppose the line of motion and do no harm at all; in fact, they keep the toboggan from slipping back down a grade on which it may be resting. This is an advantage when it is being used for hauling camp supplies and for similar purposes.

Unloaded or lightly loaded, this toboggan curls up at each end, and travels over rough ground without capsizing in a remarkable manner. Loaded, it flattens out, presenting its whole surface to the snow and bearing the weight easily and evenly. One of the photographs shows how it curls when the writer rides it standing up—a trick he does not recommend for anyone who has not learned to use skis.

Speaking of sports, how would you like to own an 11½ ft. outboard racing boat that is different from all of the rest—a boat thoroughly streamlined to obtain maximum speed and so designed that it is practically uncapsizable? The first of two articles describing the construction of such a boat, together with easily understandable working drawings, is to be published in the March POPULAR SCIENCE MONTHLY.

The barrel-stave toboggan and its two proud owners, who declare it's "king of the hill."



Perspective sketch and details showing how the barrel staves are assembled to form the toboggan.

New Ideas to Help Auto Workers

POPULAR SCIENCE MONTHLY awards each month a prize of $10, in addition to regular space rates, for the best idea sent in for motorists. This month's prize goes to Kenneth Murray, Sturgis, Mich. (Figure 3). Contributions are requested from all auto mechanics.

IN OLD cars it appears necessary frequently to touch up the breaker points. Many times this trouble is caused by a burning away of the end of the distributor arm which causes a long jump in the distributor. Building out this burned-away portion with solder is a semi-permanent cure for this trouble.

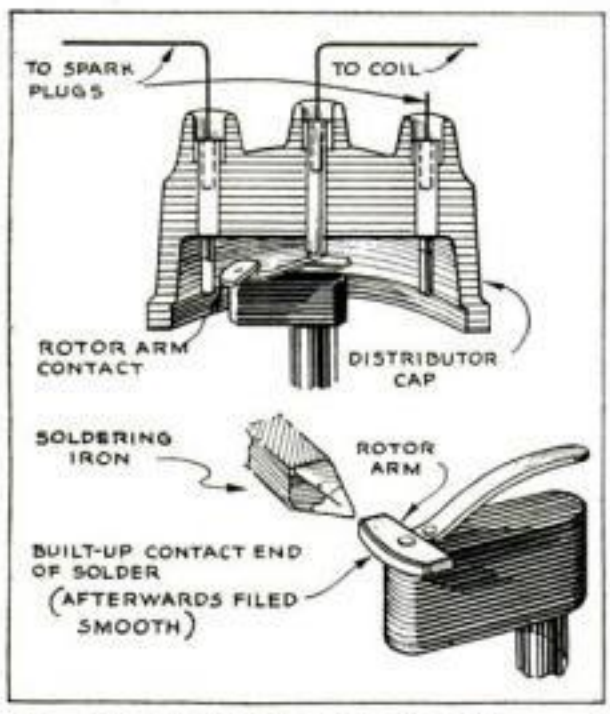


Fig. 1. Shows how to build up, with solder, the burned away end of distributor arm in an old car and make it run.

LEAKING VALVE

WHEN the exhaust valve is leaking badly a quantity of exhaust gas is drawn back through the valve during the intake stroke. If the motor is allowed to idle at the slowest possible speed, and a piece of paper is held over the end of the exhaust pipe, the leaking valve will cause the paper to be sucked against the end of the pipe.

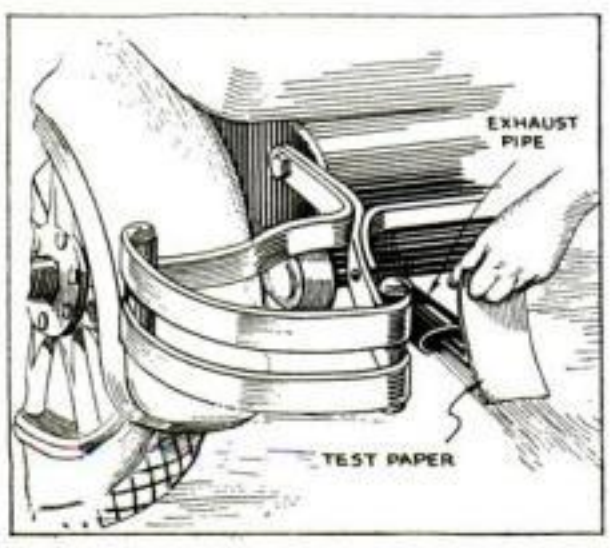


Fig. 2. If a valve is leaking badly, it can be detected at the exhaust pipe.

ACID MAY HELP

IN SOME sections of the country, the water deposits a hard white scale on the interior surface of the radiator. Ordinary cleaning compounds are of no use in such cases. As a last desperate resort try filling the radiator with a ten percent solution of hydrochloric acid. The acid will dissolve the scale but it also attacks the metal of the radiator to some extent. If you are lucky the scale will be removed before the radiator is eaten through.

A heavy scale in radiator may be removed by ten percent solution of hydrochloric acid.

ICY WINDSHIELDS

OF THE many simple methods of preventing ice from forming on the windshield, one of the simplest is shown in Fig. 4. Take a small bag of ordinary table salt and tie it to the shaft of the wiper so that it will just touch the glass at the upper edge of the path of the rubber squeegee. This will melt the ice.

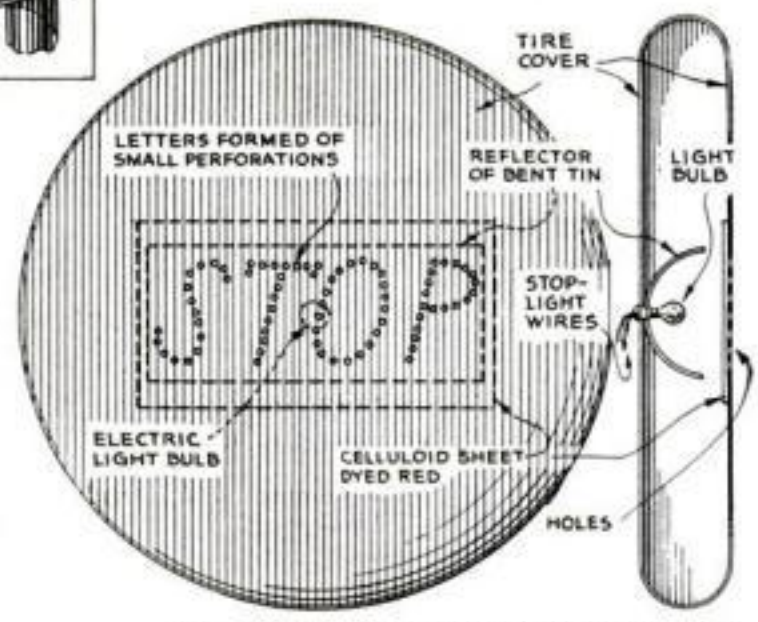


Fig. 3. This stop light is made by punching holes in tire cover and fitting bulb behind it.

NOVEL STOP LIGHT

FIGURE 3 shows how to make a stop light that disappears when not lighted and, because of the large letters, can be seen for a great distance. Punch a series of small perforations in the tire cover to form the letters of the word "stop." Cover on the inside with a sheet of red celluloid. Fit a tin reflector and a powerful headlight bulb back of the letters and connect the bulb to the usual stop light switch. This should make a peculiarly efficient stop signal, as it appears at the most desirable height and directly in front of driver in the rear.

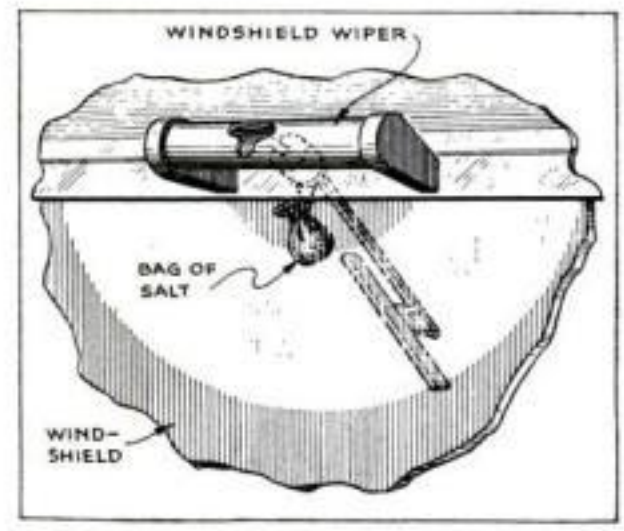


Fig. 4. A bag of ordinary table salt attached to windshield wiper will keep ice off glass.

SIMPLE PRIMER

FIGURE 5 shows an easy-to-install priming arrangement that can be applied to almost every car. Remove the fitting that attaches the vacuum line to the windshield wiper and substitute a short length of pipe and priming cup as indicated.

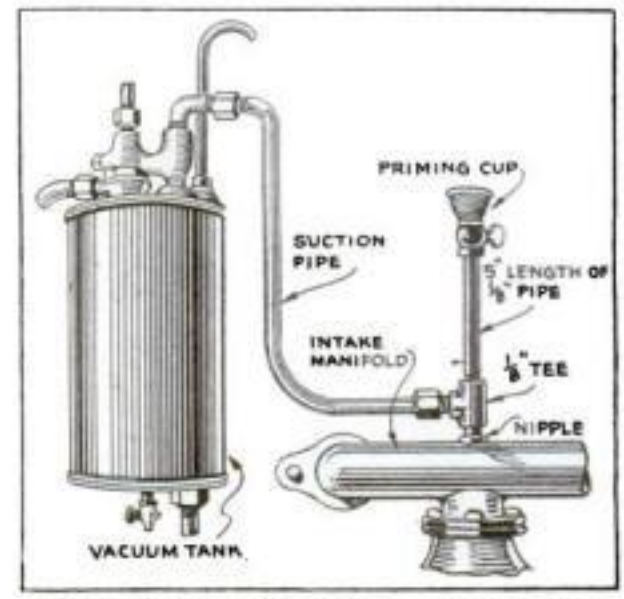
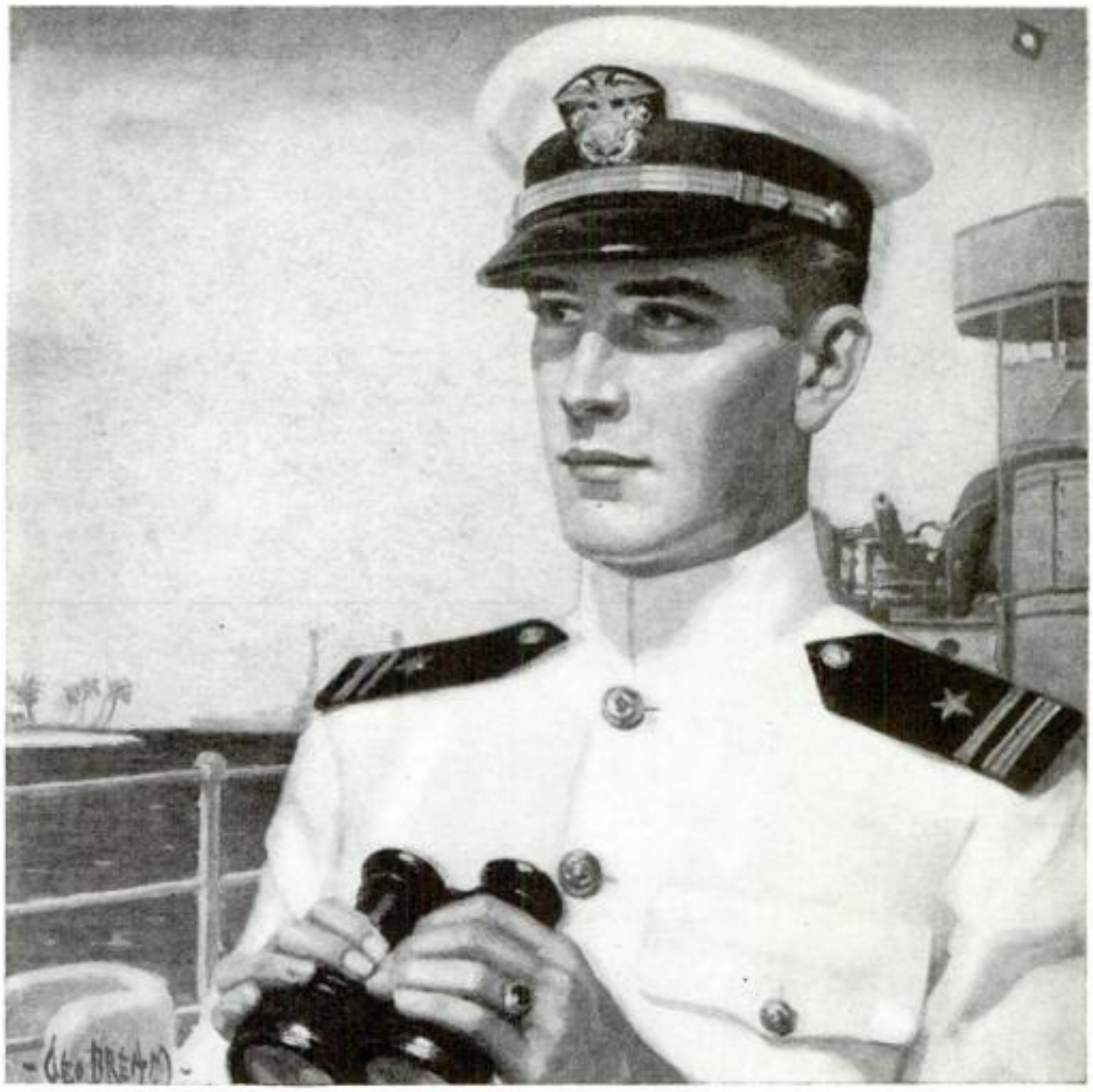


Fig. 5. This simple primer, which attaches to vacuum line, is easy to install in most cars.



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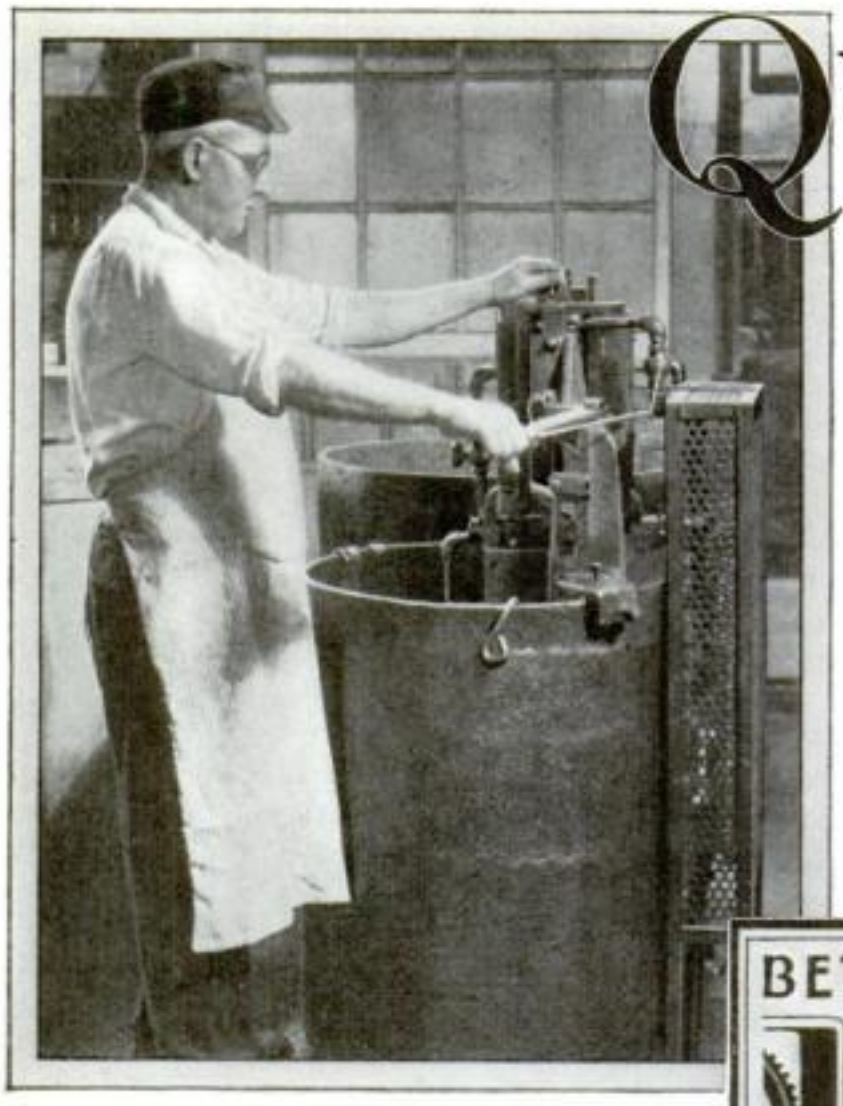
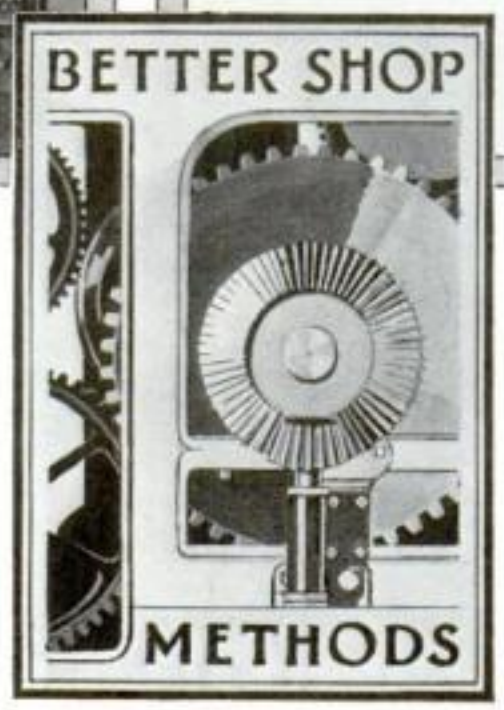


Upon the workman at the quenching bath depends the final success of the heat treating process.

Quenching Steel *Is an* Art

By HENRY SIMON

IT LOOKS so simple—just dipping a piece of steel in a tank of brine to cool it—yet Mr. Simon suggested that this article and the one that preceded it last month be called "The Art of Quenching." And art it undoubtedly is, because skill and good judgment are required. It makes all the difference in the world how the work is held and how it is moved about in the bath. The equipment may be of the finest, but success is principally dependent upon the operator's skill.



THERE is always a crucial moment in quenching steel—the moment when the work is plunged into the bath. Even if everything else is just right and all the little details have been attended to, as suggested in a previous article (P.S.M., Jan. '31, p. 98), there still remains this important operation that requires both skill and judgment.

In innumerable instances, the way in which the work first enters the bath means all the difference between success and failure. A brief moment decides whether the heating shall have been done to good purpose, or to worse than no purpose at all. And very often it settles the question of whether all the previous labor put into the piece and the cost of the steel itself result in gain or loss.

In considering this point, it is convenient, for our purpose, to draw a distinction between symmetrical work and work of approximately even section, and unsymmetrical work and work of greatly varying section. These different conditions are typified by the examples shown at *A* and *B*, Fig. 1.

If the work is symmetrical and of about even section, it is usually best to quench it with its axis vertical. If tongs are used, they should be applied as at *B*, Fig. 2, where the force of gravity automatically holds tongs and work in the correct position, instead of as at *A*, where the work is likely to be lowered in the wrong position shown by the dotted lines.

Next in importance to the manner of entering the work is the way in which it is moved about in the bath. Jumping about as shown at *C*, Fig. 2, gives the same result as at *A*, so far as the cooling effect of the bath is concerned: heat is extracted faster from the side of the work which is moving forward. The same thing, in another form, is a bath that has been stirred and made to revolve as at *D*. A brisk, though quiet, water circulation from the bottom of the tank upward, as at *E*, is excellent, but can be maintained only by a pump and a special piping system such as are found in well-equipped, up-to-date plants like the one in which the photograph above was taken.

Ordinarily, the best way is to lower work into the bath quickly though steadily and move it unhurriedly straight up and down, while changing its position gradually, as at *F*.

In work of varying cross section, the general rule is to cause the thickest portion to enter the quenching liquid first, as at *A* and *B*, Fig. 3. This cannot be done with parts like those at *C*, because air or steam would be trapped by the spaces *a*, *b*, as will be seen by studying the diagrams at *D* and *E*, which show the right and wrong ways. In some cases it is best to plunge the work as at *2*. Usually, however, it pays to provide a venthole in such parts as at *3*, even if there is no other reason for it.

Form tools and similar round parts with a heavy body and a thin flange are best

A Minute or Two in the Shop with *Old Bill*

ALWAYS plan a blanking die so that the bends in forming will run across the grain of the metal stock.

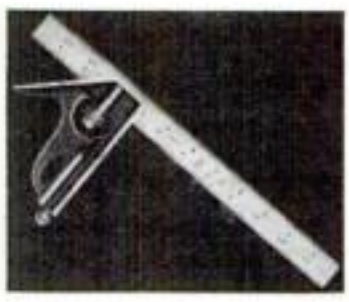
It is bad practice to take both the side and the end cuts with an end mill.

The use of a spider center when threading pipe will give a truer job, and spider centers are less expensive than pipe centers.

If a drill chatters and leaves radial marks when countersinking, it is a sign that the clearance angle is too large.

When the head of a chisel becomes rough from repeated hammerings, grind off the sharp edges or they may cause serious injury.

Always take up the slack in the lifting screw when adjusting a miller or drill press table.

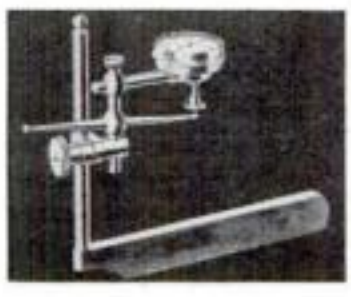


Combination Square

No. 33—hardened steel blade—graduated in 8ths, 16ths, 32nds, and 64ths—drop-forged head—eight handy tools in one.

Micrometer

No. 230—cut-away frame—lock nut and ratchet stop—0 to 1" in thousandths—finest accuracy and feel.



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No. 196—dial graduated in 1000ths—extremely sensitive—for testing, centering, and truing-up all types of work.

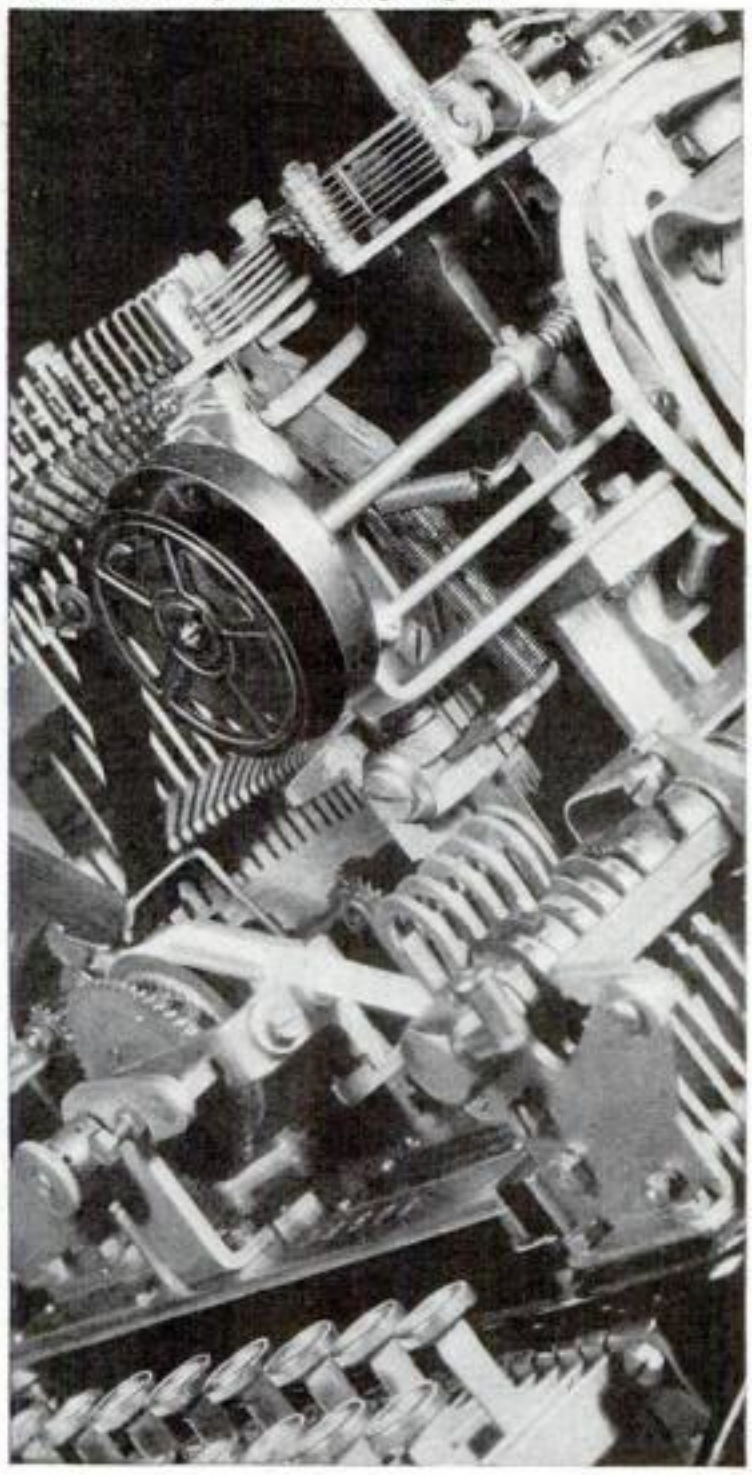
Depth Gage

No. 449—flat, blade-like rods—base is hardened, ground and lapped—range 0 to 3"—micrometer accuracy.

Protractor

No. 359—dial lock, blade lock and fine adjustment are all on upper side—vernier reads to 1/12th degree—acute angle attachment.

Close-up of the Simplex Printer, the machine used by Western Union for sending and receiving telegrams.



TYPEWRITING BY WIRE

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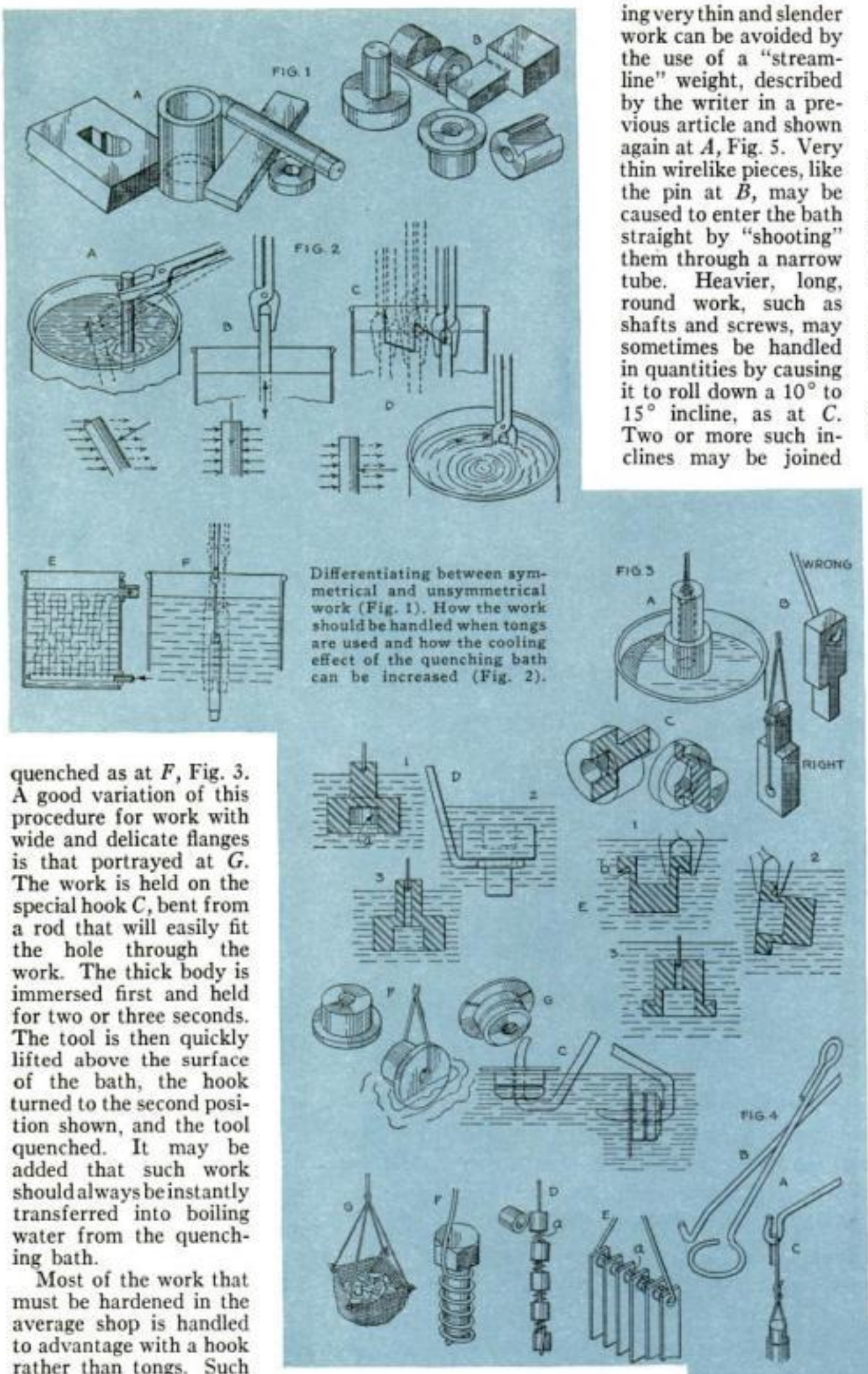


Differentiating between symmetrical and unsymmetrical work (Fig. 1). How the work should be handled when tongs are used and how the cooling effect of the quenching bath can be increased (Fig. 2).

quenched as at *F*, Fig. 3. A good variation of this procedure for work with wide and delicate flanges is that portrayed at *G*. The work is held on the special hook *C*, bent from a rod that will easily fit the hole through the work. The thick body is immersed first and held for two or three seconds. The tool is then quickly lifted above the surface of the bath, the hook turned to the second position shown, and the tool quenched. It may be added that such work should always be instantly transferred into boiling water from the quenching bath.

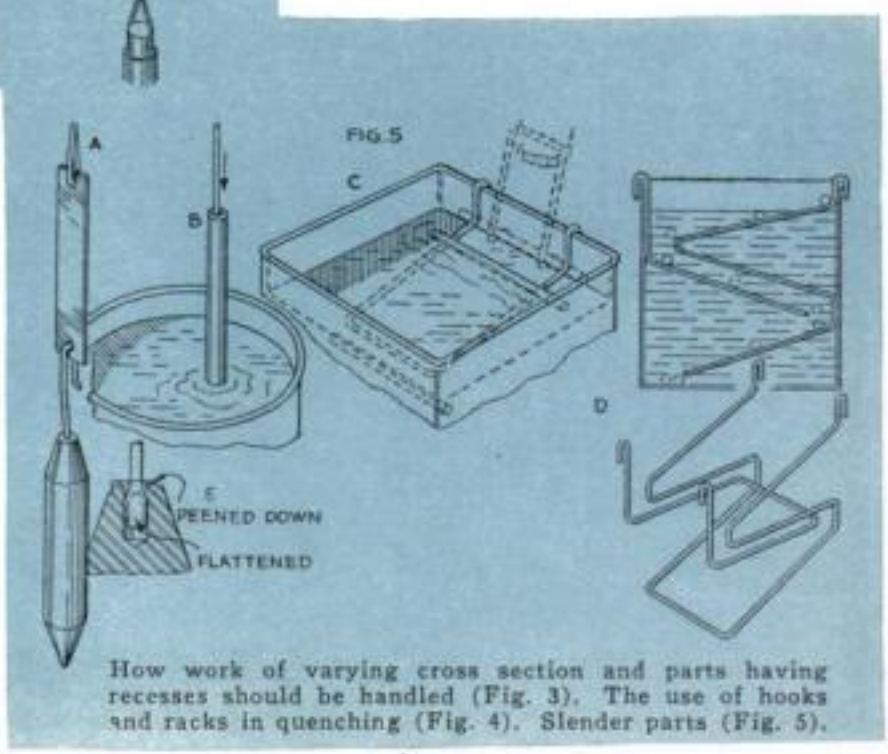
Most of the work that must be hardened in the average shop is handled to advantage with a hook rather than tongs. Such hooks may take hold both outside, as at *A*, Fig. 4, or in a bore or hole in the part, as at *B*. Where there is no other way, a wire loop may be used, even if it is necessary to provide a small hole in the part, as in the shaft at *C*.

Small parts with bores through them can be strung on a wire, as at *D*, Fig. 4, with coil wire spacers *a* between them. The same procedure may be used with flat parts, as at *E*. Screws, pins, and similar small solid objects can be conveniently suspended in wire cages like that at *F*, which can be used over and over again. Very small parts may be put up, a number —not too many—at a time, in a little bag of ungalvanized steel screening, and thus heated and quenched, as at *G*.

Many difficulties experienced in quenching very thin and slender work can be avoided by the use of a "streamline" weight, described by the writer in a previous article and shown again at *A*, Fig. 5. Very thin wirelike pieces, like the pin at *B*, may be caused to enter the bath straight by "shooting" them through a narrow tube. Heavier, long, round work, such as shafts and screws, may sometimes be handled in quantities by causing it to roll down a 10° to 15° incline, as at *C*. Two or more such inclines may be joined to give a longer path in the manner shown at *D*.

It should be remembered that work ought never to be dropped, unless it is certain that it will be thoroughly cooled by the time it strikes bottom. Even then, dropping is a poor habit unless, as in the cases just mentioned, there is some special reason for doing it.

In his next article, Mr. Simon will discuss blanking sheet metal.



How work of varying cross section and parts having recesses should be handled (Fig. 3). The use of hooks and racks in quenching (Fig. 4). Slender parts (Fig. 5).

HINTS ON USE OF TAPS GIVEN IN LETTER TO OLD BILL

DEAR BILL:

Here are a few pointers on using taps. Considerable breakage can be eliminated by drilling the work to the proper diameter. Only from 62 to 75 percent of the thread depth is needed to supply sufficient strength to cause the average screw to break before the threads are stripped.

Always keep the tap wrench tight on the square end of the tap, and as for lubrication, I prefer lard oil or a mixture of white or red lead and lard oil.

When tapping hard steel use a starting tap, alternating with a stub tap every few threads.

If a tap does break, drop some muriatic acid on the tap and allow it to work down into the threads. This will reduce the diameter of the tap slightly and often will allow it to be backed out with a hammer and punch.

F. J. WILHELM

TABLE FOR CUTTING THREADS IN LATHE

BY SETTING the compound at 30° and feeding the tool in to a depth equal to the number of thousandths indicated in the following table opposite the number of threads to be cut per inch, it is a simple matter to cut accurate U. S. S. threads in the lathe.—SAMUEL JAGGER.

Threads per Inch	Depth	Threads per Inch	Depth
2	.38676	13	.057675
2¼	.3328	14	.0535675
2½	.3000	15	.050
2¾	.261	16	.048345
3	.250	18	.0416
3¼	.2307	20	.0375
3½	.21427	22	.032625
4	.19338	24	.03125
4½	.1664	26	.0288
5	.1500	27	.0277
5½	.1305	28	.02678
6	.125	30	.025
7	.107135	32	.0241725
8	.09669	34	.02207
9	.0832	36	.0208
10	.0750	38	.0197
11	.06525	40	.01875
12	.0625		

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WHEN you buy a micrometer, rule, or any other accurate measuring tool, you are buying a tool upon which you expect to depend for years of reliable service.

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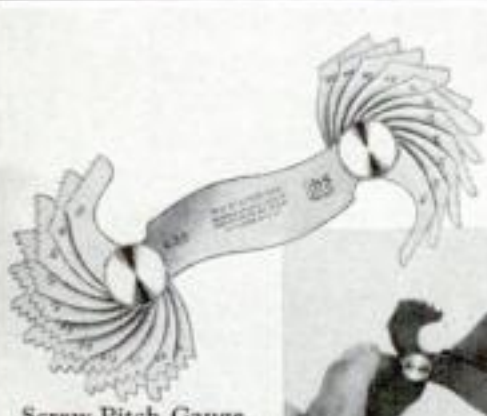
Micrometer Caliper No. 11RS

Range 0 to 1" by thousandths of an inch. Distinctive shape of frame permits measuring over projections or in shallow slots.

Micrometer Caliper No. 54

Range 0 to 4" by thousandths of an inch.

No. 55 Range 2" to 6" by thousandths of an inch—similar to No. 54 but adapted for larger work.



Screw Pitch Gauge No. 630

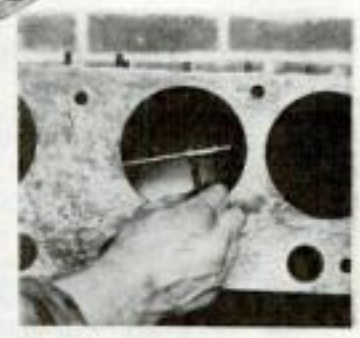
Distinctive shape of blades permits measuring threads of nuts as well as screws.

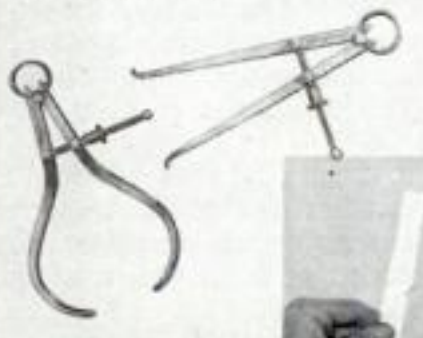
Thickness Gauge No. 648

8 tempered blades 4½" long .002", .003", .004", .006", .008", .010", .012" and .015"

Inside Micrometer No. 264

Range 2" to 8" by thousandths of an inch. The convenient clamping device is a distinctive Brown & Sharpe feature.





Outside and Inside Spring Calipers No. 811 and No. 812

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Dial Test Indicator No. 733

A most useful tool for testing, checking and set-up work.

Tempered Steel Rule No. 315 with Figured Graduations

The "right hand man" in the shop.

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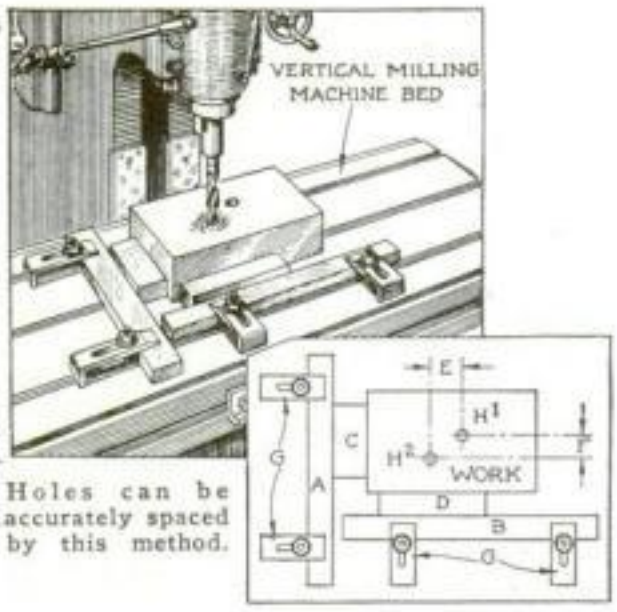
"WORLD'S STANDARD OF ACCURACY"

Locating Holes in Small Work

Boring irregular-shaped recesses in a lathe—Measuring the radius of a segment—How to slice leather belting

TO MOST tool and die makers, the job of locating holes within a tolerance of from .001 to .003 in. does not offer any great difficulty, but the task of staying within the limits of from .0002 to .0005 in. is quite another problem. The following method has been used many times by the writer with uniform success.

The work is first squared up on at least two edges, and two parallels *A* and *B* are then fastened at right angles to each other on the bed of a vertical mill or drill press with clamps *G*. Then the work is placed directly against the parallels and



Holes can be accurately spaced by this method.

the hole H^1 drilled and bored. The two blocks *C* and *D*, equal in width to the desired dimensions *E* and *F*, are next put in place, and the position of H^2 is accurately located.

These spacer blocks *C* and *D* can be made by grinding any suitable soft stock, but the common adjustable parallel is ideal for this purpose.

In spite of its simplicity, this method will produce work to limits of .0002 in. in less than one third the time necessary to do the job by the button method, which at its best will hardly produce results to limits much closer than from .0005 to .001 in.—CLARENCE J. TURCOTTE.

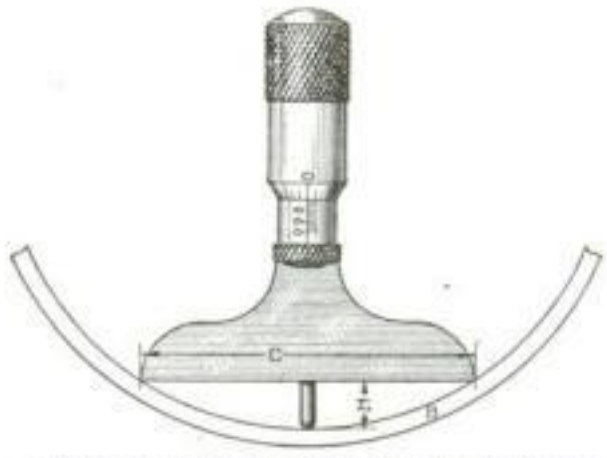
IN CASES where a drill has a tendency to run, as on a slope, or where one cutting edge is in brass while the other is in steel, or if the hole is not entirely in the metal, better results can be obtained if a small center hole is drilled first.

If a wad of waste is dropped into a hole that is to be countersunk and the drill brought down on this, the edges will cut through after a few revolutions, and, being supported by the waste, will in most cases leave a smooth countersink.

With any job where the drill is in danger, the shifter should be pulled over or the clutch engaged just enough to pull the load. If anything hangs up, a stalled machine will be the most serious difficulty that can result.—JOHN A. COOK.

A MICROMETER depth gage can be used to obtain the radius of a segment of a circle if the proper values are substituted in the following formula:

$$\text{Radius} = \frac{C^2 + 4H^2}{8H}$$



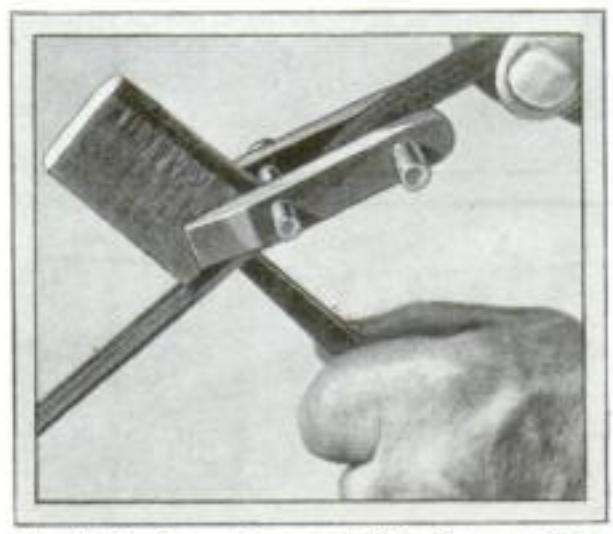
Using a micrometer depth gage to obtain the data necessary for figuring the radius of *B*.

By substituting the value for *C*, which can be measured, and the value of *H*, which can be read directly from the gage, the radius is obtained.—CHARLES KUGLER.

SLICING a length of leather belting in two in order to form two narrower belts can be easily accomplished by the method illustrated.

First, a block of hardwood the same width as the belt is tightly clamped between the jaws of a parallel clamp. The point of a sharp knife blade is then dug into the block with its cutting edge pointing toward the clamp.

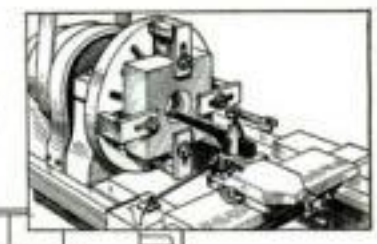
Cut a few inches of the belt by hand and pass it between the jaws of the clamp. Next, fasten the cut end of the belt firmly in a vise and holding the belt taut with one hand, and the knife steady in the other, walk away from the vise. With this method it is possible to cut belting just as fast as you are able to walk away from the vise. The jaws of the parallel clamp keep the belt centered on the block, thus insuring an even cut.—HARRY MOORE.



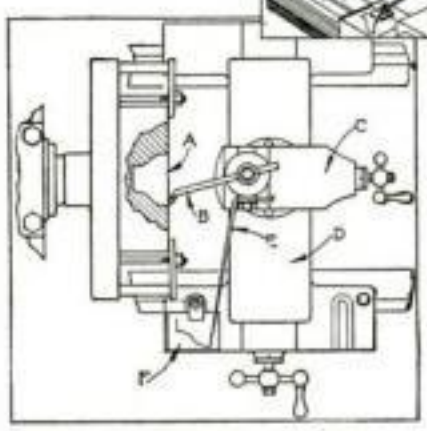
A block of wood, a parallel clamp, and a sharp knife form this simple belt cutter.

THE boring of irregularly shaped holes in a lathe having only a hand feed presents somewhat of a problem, especially when extreme accuracy is required. An ordinary cutter is not usually satisfactory and in cases where the hole to be bored has an undercut cannot be used at all. A simple yet effective method for doing this type of work, which the writer has found to be wholly satisfactory, is outlined in the accompanying illustration.

The work *A* is first strapped in the usual manner to the faceplate. The compound rest is then set at right angles to the cross-



The hand feeds are manipulated so as to keep the tracing pointer on the layout.



feed as shown, and a layout of the contour of the hole is clamped to the apron as at *F*.

The boring bar is next set at the maximum diameter of the hole and the tracing arm or needle *E* is clamped to the compound rest so that it will move with the tool *B*. It is obvious, of course, that the point of the tracer and the tool should be placed at corresponding points on the layout and the work so that both will be at the same position of the contour at the same time.

Now, by manipulating the cross-feed and compound handles so that the tracer will follow the outline on the template, a hole can be accurately bored to the shape desired.

ALMOST every grinding spindle has at least .001 or .002 in. end play, but when accuracy is of utmost importance this allowance on a surface grinder becomes a source of trouble. This end play, however, can be eliminated by the application of a simple kink. A ¼-in. steel ball is placed in the center hole at the end of the shaft, and a piece of spring steel is clamped to the wheel guard in such a way that its free end is in spring contact with the ball. In cases where only a small amount of pressure is needed, a discarded hack saw blade can be used in place of the spring steel.—H. J. CHAMBERLAND.

Announcing the LE BLOND REGAL LATHE

A precision lathe with the latest engineering features—8-speed selective geared headstock—quick change geared feed—feed rod (takes the wear off the lead screw)—deep rigid bed of close grained nickel steel alloy iron—built-in motor with V belt drive—furnished with all necessary equipment and ready to operate.

Size:
10' x 3'

$398.00

Every Regal Lathe carries the LeBlond guarantee

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Regal Lathes are made in various sizes. The one shown is 10 inches by 3 feet. It sells for the low price of $398.00. Lathe is shipped to you promptly upon receipt of $79.60. Balance in monthly payments of $27.86.

Write for detailed description, sizes and prices of the complete Regal Line.

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Here Is a Parrot to Hold Your Reading Lamp

Not a real, live polly, but a gay wooden bird that anyone can build

By DALE R. VAN HORN

The completed parrot light in use. Either a round or a shield type shade can be used.

AFTER the evening meal, when a man settles down in his favorite chair for an hour with the sporting extra, his enjoyment is made more complete by having a well-placed, attractive looking reading lamp at his side—one that will throw the light just where he wants it. The parrot lamp shown in the accompanying illustrations was designed for this very purpose, and it has the additional advantages of being colorful in appearance and distinctly original in design. You couldn't duplicate this lamp in any store; it is a genuine novelty.

The parrot, cut from wood and brilliantly painted, sits patiently on a perch and holds the light in the best position for reading. What appears to be a feed dish beside the bird can be used as a receptacle for ashes, if desired, although the main purpose is to add to the realistic effect. The perch itself is mounted on a neatly turned standard supported by four shaped legs.

Novel as it is, the parrot lamp is relatively easy to construct, especially if your shop boasts some of the modern motorized equipment now so generally in use.

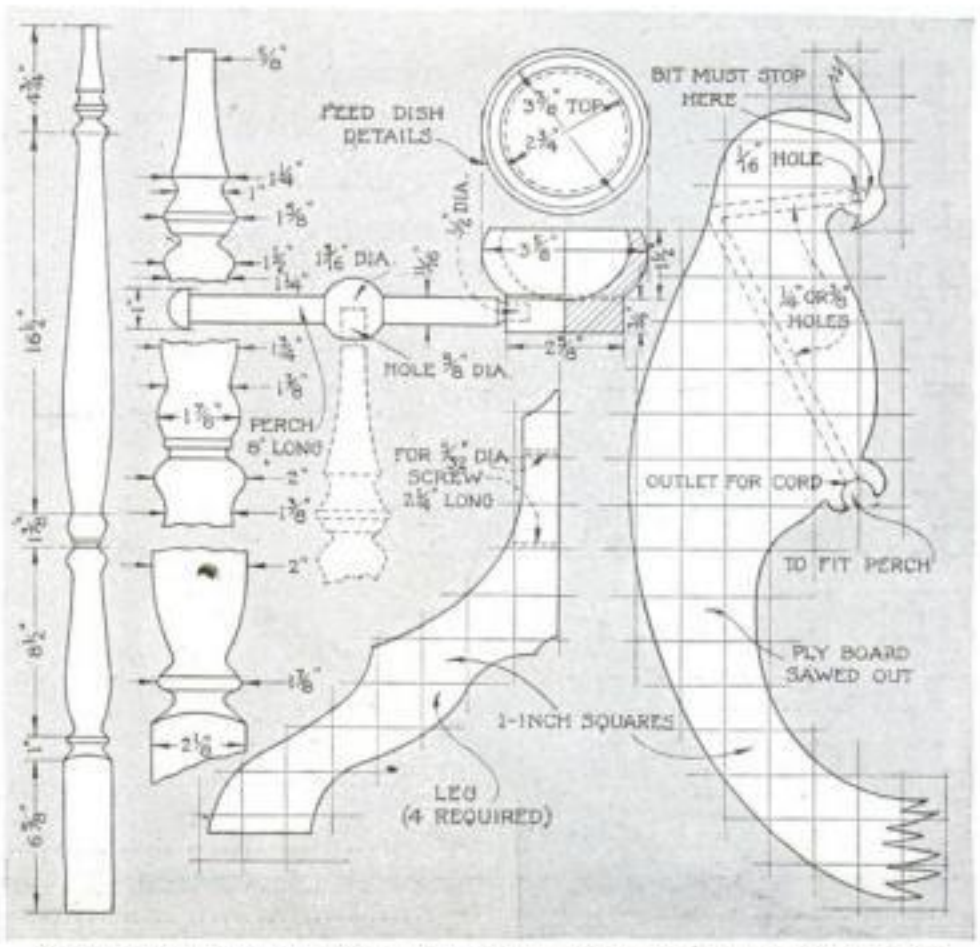
You should first shop around for a bill of materials about like this:

1—2¼ by 2¼ by 41 in. wood for the upright (walnut or other hardwood preferred)
1—1¼ by 1¼ by 8 in. wood for the perch
1—five-ply wood ¾ by 18 by 30 in. for the four legs and the parrot
1—glued-up block 4 by 4 by 2½ in. for the feed dish
1—assembled electric light fixture cord with plug and socket, 50-watt bulb, and appropriate shade
8—5/32 in. diameter roundhead (No. 7) screws, 2¼ in. long
Glue, putty, several brushes, colored lacquer or paints, etc.

With a band saw, the cutting out of the legs and the bird can be done in ten minutes, but a jig or coping saw will do the work as neatly, although, of course, less rapidly. Smooth the cut edges with sandpaper and inspect them for any holes within the laminated structure. Such holes can be plugged with wood, whittled to shape and coated with glue, or a plastic compound.

A genuine novelty in reading lamp design.

All band-sawed edges should be thoroughly and carefully sanded.



Drawings of the parts. Full size outlines of the parrot and legs can be obtained by transferring the lines to paper marked off in 1-in. squares.

position may be used. When one leg has been cut out and sanded, it may be used as a pattern for the other three pieces. A sanding spindle set between the lathe centers and carrying two or three grades of sandpaper will facilitate smoothing the curved surfaces if a drum sander is not available. Give the legs a coat of walnut stain and wipe off the surplus. Then cut out and sandpaper the parrot.

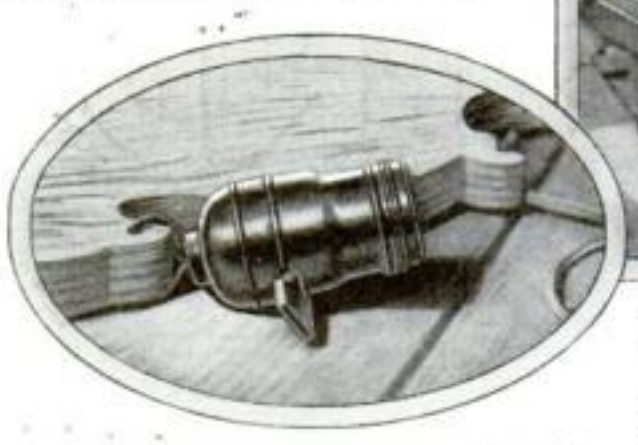
Put the main standard between lathe centers and turn to the shape and size shown. Make what variations you please; your own design is likely to prove more effective than the one shown. See, however, that the top end (which must be tapered) has a mean diameter of ⅝ in.

Sand the turning smooth, taking care that all tool marks are removed; then stain the wood while still between centers. Start the lathe and wipe off the surplus stain with a rag. Rub down again with fine steel wool held lightly. Stop the motor and rub the steel wool with the grain to take out any traces of sandpaper scratches. Next, apply clear lacquer with a soft brush or rag, allow it to dry for five minutes, and then rub it down with a clean rag. In an hour or two, apply another coat and repeat the rubbing. Give a final finish with wax. This is a quick, simple method, if the wood is to have a natural finish. In

(Continued on page 108)

This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS. See page 8.

the same manner, finish the legs; and to speed up the rubbing, you can cover a wooden spindle with cloth, set it in the lathe, and run both the flat sides and the curved edges over it. Hold the pieces with a light touch or the lacquer will become heated and may rub off.

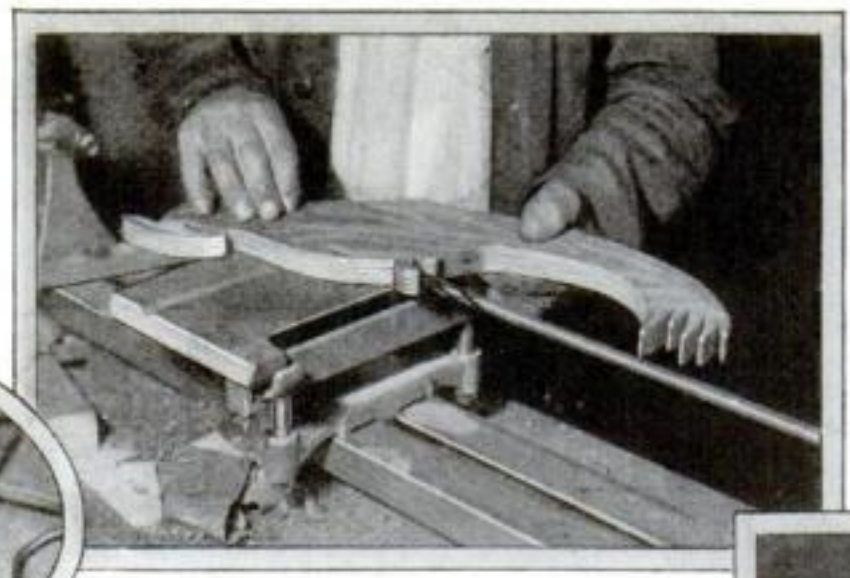


Detail showing how the wires are brought out through holes in each side of the bill.

Turn the perch with a 1 3/16-in. ball a little to one side of the center. Taper one end to fit a ½-in. hole in the cup or tray. The other end should have half of a 1 in. diameter ball with a sharp shoulder. The central ball should be carefully bored halfway through with a bit; use a small drill first to make a guide hole for the bit screw in order to prevent splitting. Finish the perch as described before, but leave a small area unfinished where the parrot is to sit and along the tapered end.

The cup is turned from a glued-up block of the dimensions shown and is similarly finished. Use only the best quality of liquid, casein, or hide glue to insure satisfactory, permanent joints throughout.

Returning to the parrot, set up a bit in the lathe chuck, fix the table at the proper height, and bore the two holes for the light cord shown by the dotted lines in the drawings. Both holes start at the same point at the back edge. Small holes, one on each side, are made in the bill at the point indicated; these should meet the end of the larger hole. Through these holes are led the single wires of the cord, which are drawn through far enough to allow the light socket to be wired. The surplus cord is then pulled back through the holes, all the slack taken up, and glue is inserted to hold the cord taut. Putty the holes and space around the wires, or fit plugs to be glued in, and sandpaper them off smooth. A groove in the bird's foot serves as an outlet for the electric fixture cord.

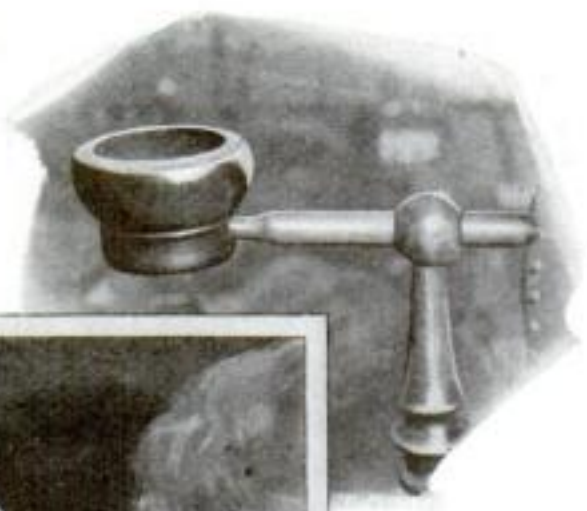


Drilling the holes for the wires. The positions of these are shown in the drawings.

Now coat the inside of the foot with glue and wipe glue around the perch and where needed; then set the bird in place. The exact position is optional, but the parrot should tilt far enough forward to permit the light to hang naturally.

Fasten each leg with two 2¼-in. No. 7 screws. In making the original lamp, a jig was set up to drill the screw holes in the legs accurately at the points shown; then the jig was readjusted and small holes were drilled on the lower end of the upright to indicate where the screws should enter. It is advisable to sand off the finish from the portions of the upright the legs are to cover, and apply glue here before the screws are turned home. Test the stand on a level floor and sand down the bottom of any leg which happens to be too long.

The grain dish. If this is supplied with a glass receptacle it can be used as an ash tray.



Applying the colors to the parrot. Blue, red, green, yellow, and white lacquers were used.

The parrot can be painted realistically by one skilled with a brush, and the tones carefully blended to give a natural effect. If, however, you have any doubt as to the ultimate success of this artistic work and can call upon no artist for assistance, paint the parrot in a strictly modernistic fashion with blue, green, yellow, and red, to suit your own fancy.

While it is desirable to use walnut or other good cabinet wood for the perch, cup, upright, and legs, you may, as a suggestion, use softer woods throughout and finish all the parts in opaque paints or lacquers. For example, gray could be used for the body color, with Chinese red for the trim. You can, of course, get the plywood for the parrot and the legs in facings of walnut, gum, birch, or almost any other wood you might wish, but in case your local dealer does not stock these, you can make the parrot of pine plywood and the legs of solid gum, walnut, or other hardwood for the clear-finish method.

The choice of shade to be used is a matter of personal preference, both the round and shield type being applicable.

The four band-sawed legs are held in position on the standard with glue and screws.

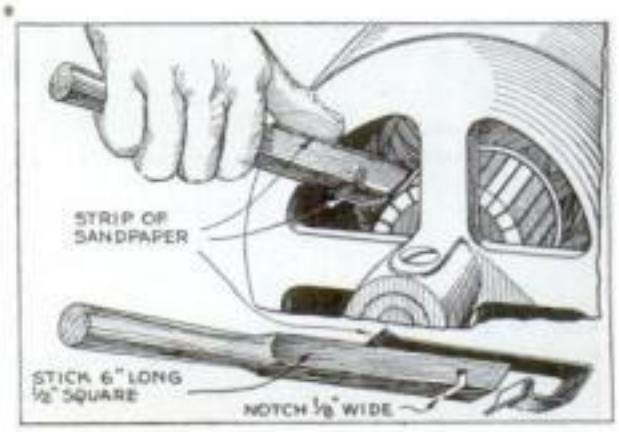
SANDPAPER HOLDER FOR COMMUTATOR WORK

SANDPAPER is often used to clean motor commutators that have a streak of carbon all the way around which is "shorting" the sections, or to resurface them if they have been worn uneven by the carbon brushes. The open space in the motor housing is generally so small that it is difficult to hold the sandpaper in the fingers, but work of this sort can be done conveniently with a stick shaped as illustrated.

The sandpaper is cut into ½-in. strips. The end of one of these is doubled over for about ½ in. and fitted into the notch, which holds it firmly. The rest of the sandpaper strip is looped over the end of the stick, and the loose end is held with one of the fingers against the stick.

When the sandpaper is worn down, a short piece is torn off at the notch end of the stick and a fresh portion used.

Quartz sandpaper should always be used, never emery cloth, as the emery is likely to short-circuit the commutator or windings.—C. C. PFEIFFER.



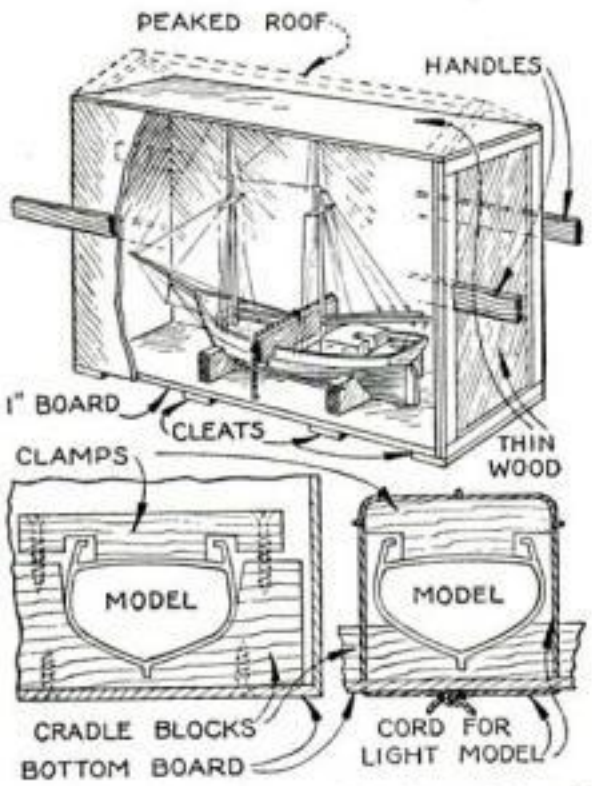
Cleaning motor commutators becomes less of a problem when a sandpaper stick is used.

BOXING MODELS SAFELY FOR SHIPMENT

AIRPLANE and ship models may be packed in the manner illustrated below with reasonable assurance of safe delivery, barring accidents. Only the hull or fuselage is fastened to the case.

First, measure and make the bottom, allowing sufficient clearance for wings, spars, bowsprit, and other parts. Use 1-in. stock for the bottom and the cross cleats at the ends and under the cradles. Set the model on the bottom and locate the position of the cradles. For a ship they should lie about where the turn of the bow and stern begins and at a clear space on the deck for cleats to hold down the model.

Shape the two cradles carefully to fit the bottom of the model and use thick



Methods of packing a model. A peaked roof and handles are desirable for a large case.

enough stock to hold screws well. They may be lined with something soft to prevent chafing. Fin keel models may be molded down in a board or shelf to about the water line, and the shelf firmly built into the case. Fasten the cradles to the bottom with at least one long screw at each end, driven up through the bottom. A notched block may be fastened at the bow and stern to prevent fore-and-aft slip.

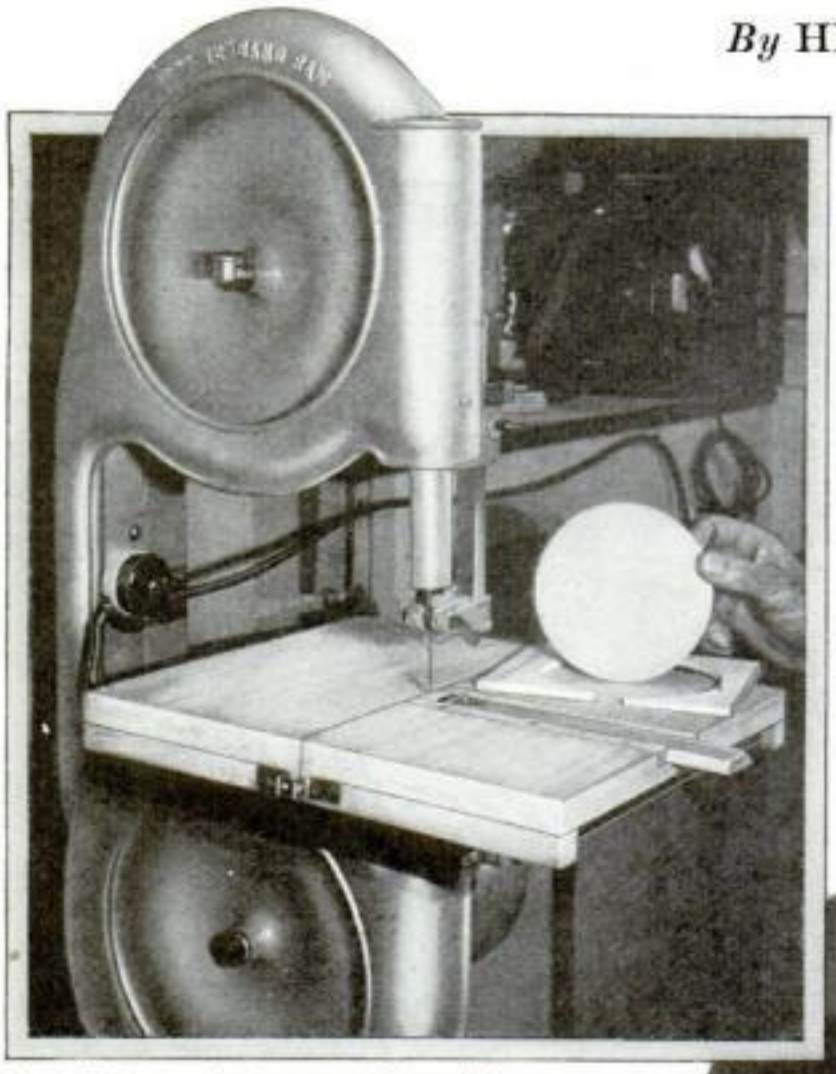
Now set the model on the cradles and measure for the frame of the case. Finish the frame and cover it with thin plywood, wall board, or any thin lumber. Build the lid or cover, which is to be screwed on after the model is fastened.

A light model may be lashed in one cradle with cord passed across the deck and down through the holes in the bottom. Heavy models require cleats across the deck; these must rest on the deck—not on the gunwales—and be screwed to the cradles. Lash down loose anchors, small boats, and the like.

Valuable models or delicate old ones may be packed in two cases, one inside the other, with wadded paper or excelsior around the inner case. Heavy or large cases may have handles on the sides and a peaked roof. Letter the warning "Ship (or Airplane) Model—Fragile" on all sides of the case.—HENRY GEORGE.

Cutting Circles on a Band Saw

By HERBERT WOOLSEY

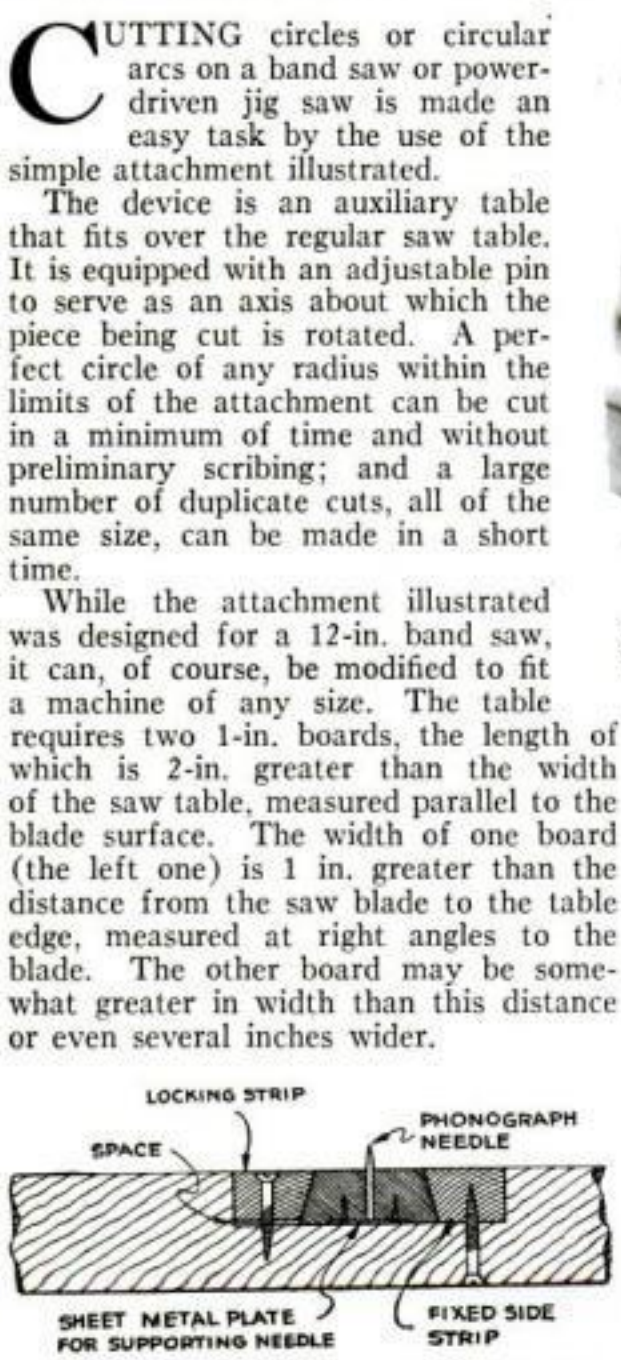


No skill is required to cut perfect circles on a band saw equipped with this attachment.

CUTTING circles or circular arcs on a band saw or power-driven jig saw is made an easy task by the use of the simple attachment illustrated.

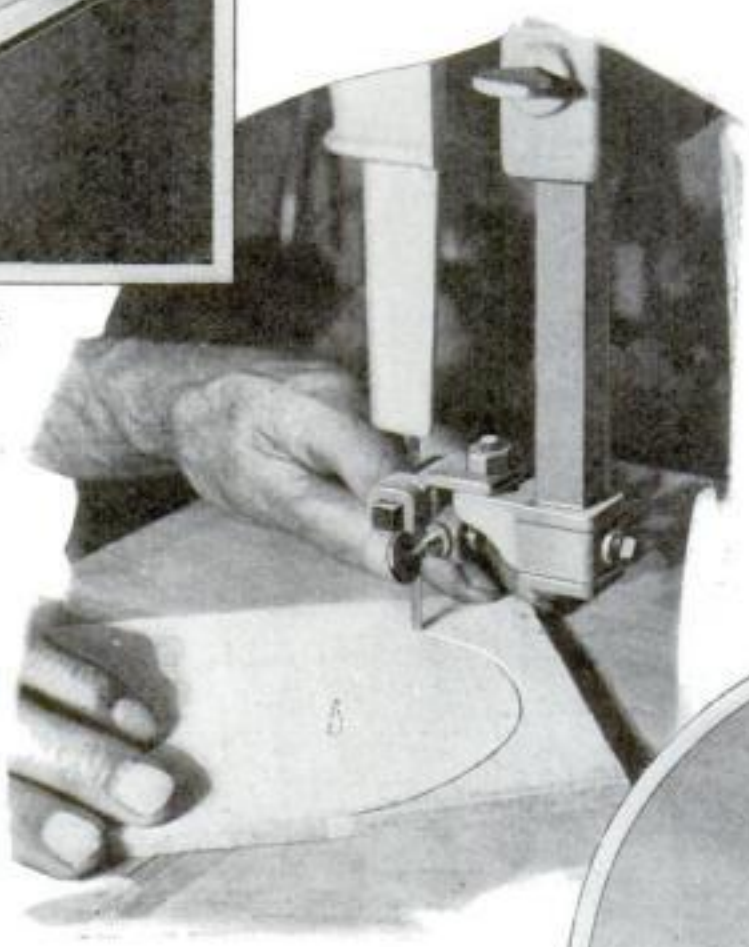
The device is an auxiliary table that fits over the regular saw table. It is equipped with an adjustable pin to serve as an axis about which the piece being cut is rotated. A perfect circle of any radius within the limits of the attachment can be cut in a minimum of time and without preliminary scribing; and a large number of duplicate cuts, all of the same size, can be made in a short time.

While the attachment illustrated was designed for a 12-in. band saw, it can, of course, be modified to fit a machine of any size. The table requires two 1-in. boards, the length of which is 2-in. greater than the width of the saw table, measured parallel to the blade surface. The width of one board (the left one) is 1 in. greater than the distance from the saw blade to the table edge, measured at right angles to the blade. The other board may be somewhat greater in width than this distance or even several inches wider.



Sectional sketch of the attachment showing how the wood strips are cut and assembled.

The boards are held in place on the table by four 1 by 1 in. cleats on the underside. These cleats pass along the edge of the saw table and also serve to hold the two boards in position, with a space between them equal to about twice the thickness of the saw blade. The cleat along the front edge must be cut in two so that the band saw blade will enter the slot. A locking device consisting of two small right-angle brackets and a bolt and nut holds the boards in position and also makes the attachment grip the saw table edges firmly.



With the stock pivoted on the needle, it is necessary only to revolve the work.

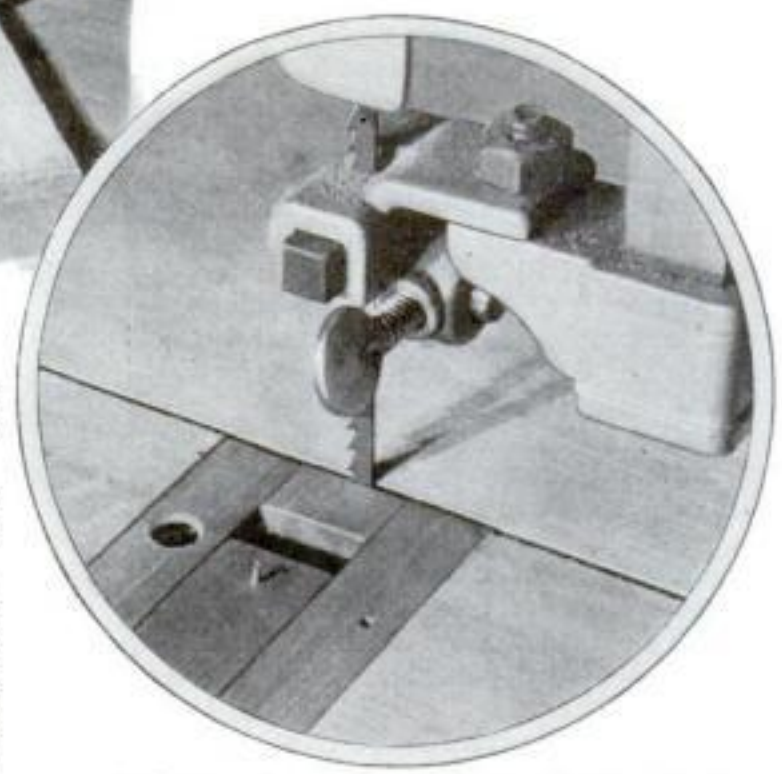
The center about which the stock being cut is rotated is a large phonograph needle inserted in a hardwood slide that is adjustable as to its distance from the saw blade. First, cut a groove 2 in. wide and ⅜ in. deep in the outer board of the circle-cutter, using, if possible, a circular saw and dado attachment. Smooth the slot with a wide chisel. The slide, preferably made of maple or birch, is 1 in. wide at the bottom and about ¾ in. at the top, both edges being beveled equally—to about 15° or 20°. It should be about 2 in. longer than the groove.

After completing the slide, cut two strips, each with one edge similarly beveled, and of a width that will permit them, with the slide, to fill the groove snugly. One of these strips should be the same thickness as the slide; the other, about 1/16 in. thinner to allow for tightening.

Mount the thicker of the side strips solidly at the side of the groove furthest from the operator. Drill three holes in the other—the thinner—side strip to receive small flathead wood screws. Insert the slide, then set the drilled side strip in place and drive the screws, countersinking the heads deeply. The three pieces should fit so that, when the wood screws are loose, the slide can be moved easily, but when they are screwed down, it will be locked in place securely. You can lubricate the slide with soap, if necessary.

The phonograph needle is cut to a length that will permit its projecting upward about 3/32 in. On the underside of the slide, directly beneath the needle, make a shallow recess and fasten in it a piece of sheet metal, so that pressure on the needle point will not force the other end down into the bottom of the groove.

A block ½ in. wide is fastened in the groove at the saw-blade end so that the slide will not be forced into the blade. A scale may be added to facilitate slide adjustment, if desired, the saw blade being at the zero point.



A close-up view of the attachment showing the pivot needle, the sliding strip, and a locking screw.

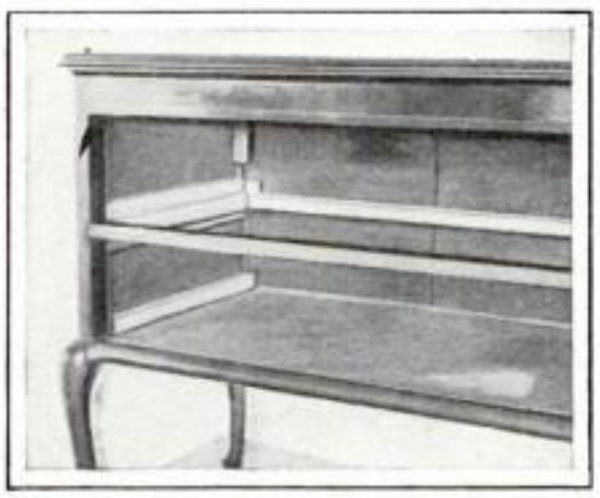
WHEN soldering tinned copper or tin plate, an otherwise neat looking job is sometimes spoiled by the solder's spattering and sticking to the work. This can be easily prevented by coating the surfaces nearest the seam to be soldered with a heavy mixture of whiting and water. This will effectively keep the solder from sticking.—V. C. DARBY.

OLD-STYLE PHONOGRAPH CABINET CONVERTED INTO A LOWBOY

This graceful looking lowboy was once an obsolete and valueless phonograph cabinet.

A DISCARDED phonograph cabinet of the style popular a few years ago can be converted into a presentable lowboy with very little trouble. Remade in this way, the piece is worth far more than an out-of-date phonograph.

How the transformation is effected can be seen from the accompanying photographs. The only puzzling part of the work was to devise a way to conceal the holes where the crank and volume control came out of the end of the case. This was done by carefully fitting in a piece of veneer that had been previously finished in a tone exactly matching the phonograph cabinet. The patching was hardly noticeable, and the remodeled cabinet, when well polished, looked like a new piece of furniture.—M. D. TAYLOR.

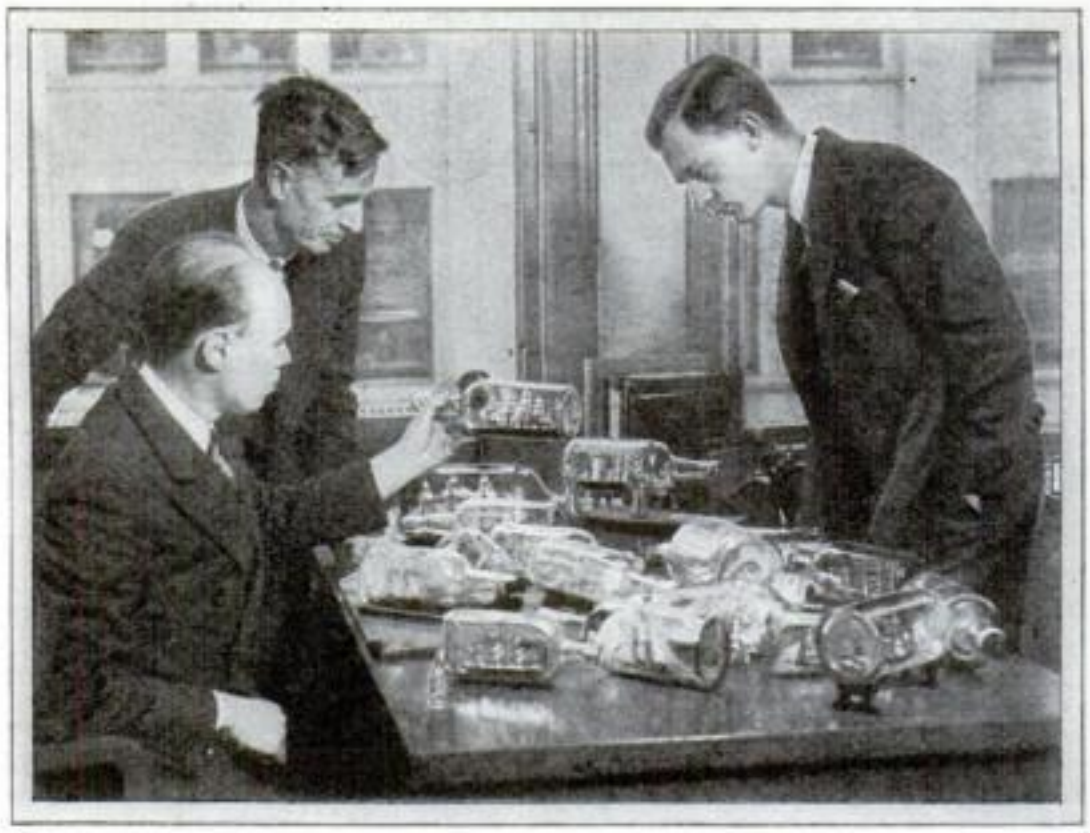


Interior view illustrating how the supports and guide strips for the drawers are placed.

TOOL HANDLE FERRULES

FERRULES for tool handles can be made from the small screw caps often used instead of corks on small bottles containing drugs and patent preparations. Punch a hole or cut a slot in the top of the cap and, if you wish, flatten out the rolled threads with a hammer. Two center punch marks will hold the ferrule securely on the handle.—W. G. W.

IT IS always difficult to keep small dies clean, for filings so minute as to be almost invisible will prevent the clear cutting of fine threads. A solution is to clean the dies, before they are started down the rod, with pipe cleaners.—M. E. CRUMB.



The judges deciding on the winners of the Ship-Model-in-a-Bottle Contest after having narrowed down the competition to twenty of the best models submitted.

Readers Build Amazing Ship-in-Bottle Models

And ten of them win prizes for their work

CRAFTSMANSHIP of an extraordinary character was displayed by many readers who entered our recent Ship-Model-in-a-Bottle Contest. The number of entries was far larger than had been expected, and the general standard of quality was nothing short of amazing.

The judges found it desirable to award four special prizes in addition to the six originally announced and to give honorable mention to six other model makers. The list of winners is as follows:

First prize, $50—Charles V. Nielsen, Carlstadt, N. J.
Second prize, $25—Kenneth A. Young, Washington, D. C.
Third prize, $10—Harold T. Bodkin, Chicago, Ill.
Fourth prize, $5—Anthony Spilich, New York, N. Y.
Fifth prize, $5—William E. Green, Seattle, Wash.
Sixth prize, $5—Louis Cochard, Veterans' Home, Napa County, Calif.

Four special awards consisting of two years' subscription to POPULAR SCIENCE MONTHLY—Edward W. Roberts, Fort Stanton, N. M.; Bireley Ross, Coleman, Texas; Louis Salo, East Port Chester, Conn.; and Raymond Smith, Lawton, Okla.

Honorable mention—J. R. Campbell, Richmond Hill, N. Y.; William E. Chamberlain, Boston, Mass.; Joseph A. Lindquist, Hempstead, N. Y.; F. F. Mitchell, Phoenix, Ariz.; Charles W. Sheppard, Coldwater, Ont., Canada; and William H. Swayne, Piedmont, Calif.

Mr. Nielsen submitted two models of the clipper ship *Flying Cloud,* one with sails, which was awarded the first prize, and the other with standing rigging only. The winning model, which is in a quart bottle with a neck opening of a scant ¾ in., is 4⅝ in. long over all, 2⅞ in. high from keel to top, and has a hull a scant ⅝ in. in width and ⅜ in. in depth amidships (see illustration below).

The second prize model by Mr. Young is the bark *The City of New York,* Rear Admiral Byrd's South Pole ship. It also is

The winner of the first prize, a delicate model of the clipper ship ***Flying Cloud*** **in full sail.**

BLUEPRINTS FOR YOUR HOME WORKSHOP

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. Each subject can be obtained for 25 cents with the exception of certain designs that require two or three sheets of blueprints and are accordingly 50 or 75 cents as noted below. The blueprints are each 15 by 22 in.

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104. Tractor (record flight 6,024 ft.)

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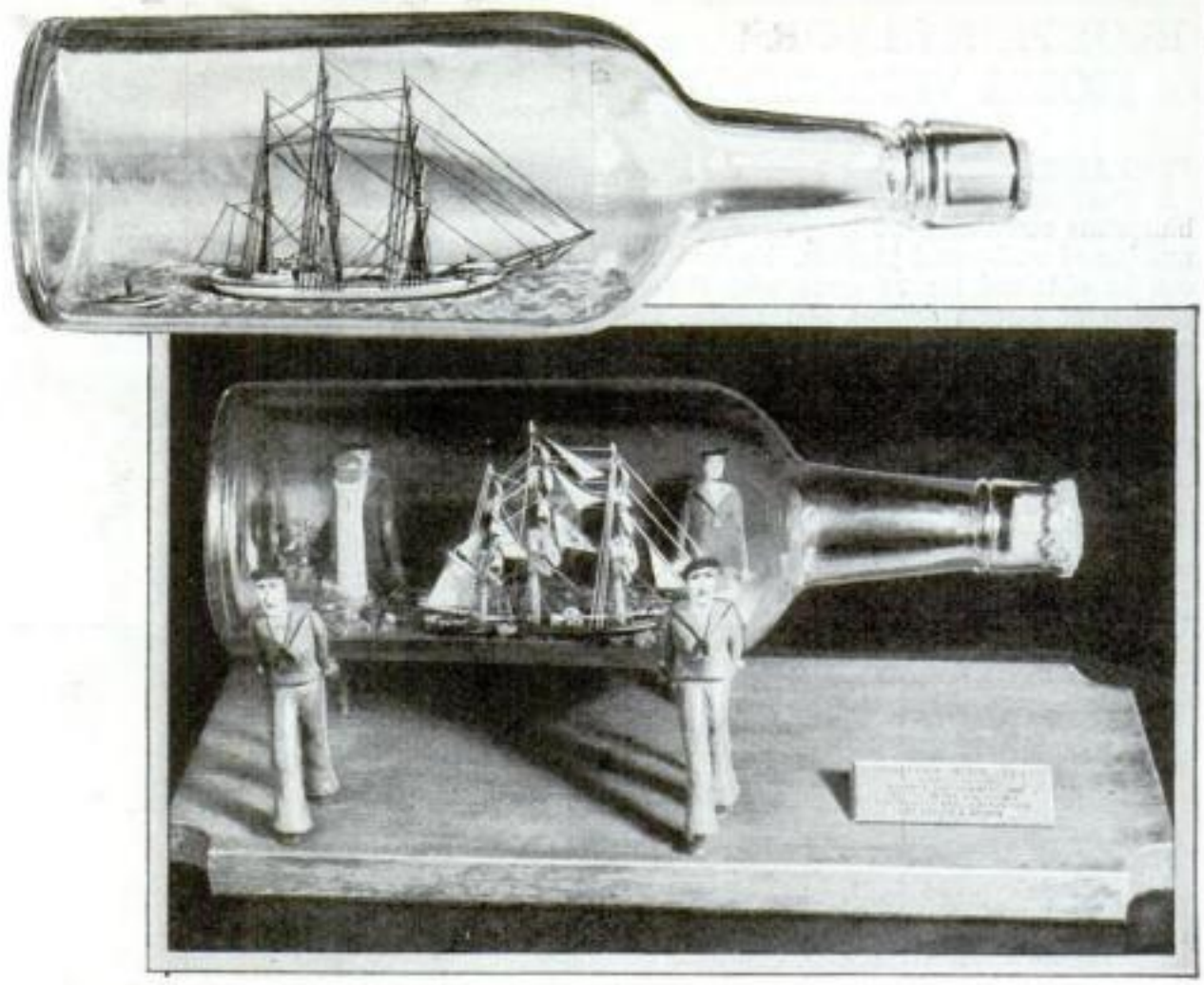


A model of Rear Admiral Byrd's bark *The City of New York (at top)* won second prize, while a beautiful model of the *Sovereign of the Seas* was awarded the third prize.

in a quart size bottle with the neck opening $1\frac{1}{16}$ in. in diameter. The length over all is $4\frac{5}{8}$ in. and the mainmast is $2\frac{3}{4}$ in. high. The masts are assembled with crosstrees, trestletrees, and tops, and the details are correct even to such things as the rail on the stern, which is carved from the solid block of the hull.

THE title of Mr. Bodkin's entry, which won third prize, is "*Sovereign of the Seas,* Outward Bound." It is a fine example of minute workmanship, the builder having used a jeweler's glass in shaping many of the extremely small parts. For example, each anchor is about $\frac{1}{8}$ in. long and built up from four separate pieces of celluloid, and the chains are of knitted thread, blackened and then brushed with bronze to represent rusted links.

Mr. Spilich's model is also one of the *Sovereign of the Seas* built to the scale of $\frac{1}{64}$ in. equals 1 ft. Mr. Green submitted a model of the *Canada,* of the old Black Ball line, in a gallon size bottle. The model nearly fills the large bottle, yet it was inserted through a neck so small that it will not allow a five-cent piece to pass. In fact, Mr. Green had to insert the hull in halves. In addition to this remarkable model, he submitted two models in tiny flat bottles which are only about $\frac{5}{8}$ by $1\frac{3}{8}$ by $2\frac{1}{2}$ in. over all. One of these curious little models has been presented by Mr. Green to Governor Roosevelt of New York, who is an enthusiastic collector of ship models. Mr. Cochard's model, which was built in a half-gallon bottle, is unique in that it is treated decoratively rather than realistically, and the rigging is of gold colored silk.

All these models have to be seen to be appreciated. They would stand out as exceptional examples of craftsmanship in any exhibition of ship models. So perfect are they in detail that all would be complete and excellent models even if they were enlarged to regular mantelshelf sizes.

While there were some old sailors among the contestants, the majority proved to be men in other lines of work, including advertising and banking. Several models were entered by boys and others by men of great age, the oldest being L. F. Baldwin, of Albany, N. Y., who is in his eighty-third year. One creditable model of a Spanish galleon was submitted by Miss Hazel Way, of Chicago, Ill.

The same general method of construction was used in making all the models; that is, each model was built outside the bottle and then folded into a compact bundle which could be slipped through the neck and reassembled by raising the masts in the manner described when the contest was announced (P. S. M., Aug. '30, p. 71).

The judges of the contest were Capt. E. Armitage McCann, secretary of the Ship Model Makers' Club, and the technical and home workshop editors of POPULAR SCIENCE MONTHLY.

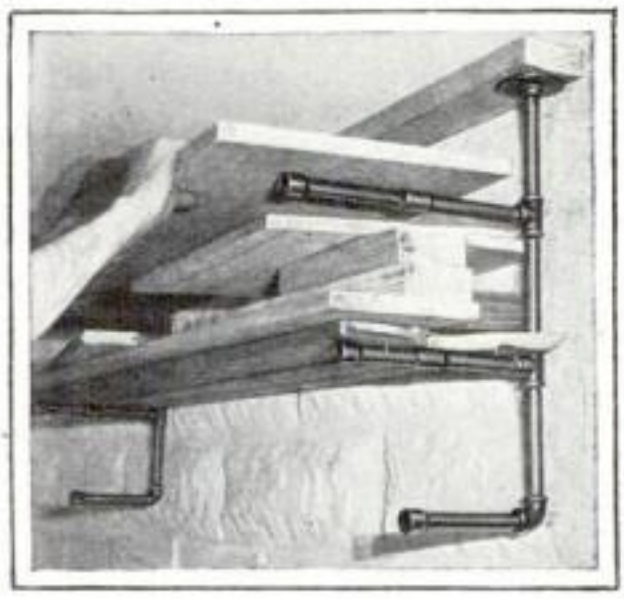
SAFETY GOGGLES PROTECT EYES WHILE SAWING

SAFETY goggles with nonshatterable glass should be part of the equipment of every home workshop. I use a pair of metal-framed goggles with a sort of fine screen cup on either side. Once when I was sawing some $\frac{1}{16}$-in. ebony, the goggles saved the sight of my left eye because the saw, tearing through the hard, brittle wood, drove a tiny splinter with such force that it actually stuck in the nonshatterable glass. Ordinary glass would have broken. Because of this experience, I make a practice of wearing goggles whenever I use either the lathe or the circular saw and, of course, always when using a grinding wheel.—W. F. B.

PIPE FITTINGS USED TO MAKE LUMBER RACK

A STURDY rack for the storage of lumber in the shop can be made from standard pipe fittings. The rack consists of two brackets, which are fastened to the ceiling or wall, and provides a number of horizontal arms on which boards, molding, and similar materials can be stored in the manner shown below.

The brackets illustrated, which are used in a low-ceilinged basement, were



The rack, which consists of two brackets, can be fastened to the ceiling or side wall.

made from ½-in. fittings, the following materials being required for each bracket: One floor plate, six 6-in. nipples, one 5-in. nipple, one 4-in. nipple, two tees, one elbow, two couplings, and three caps.

The top arm consists of two 6-in. nipples, a coupling, and a cap. The middle arm includes the 4- and 5-in. nipples, and the lower arm a single 6-in. nipple. The hanger can be fastened to the ceiling with heavy bolts or screws. For side mounting, a street elbow should be interposed between the floor plate and the adjacent nipple.—WALTER E. BURTON.

Assembling one of the brackets. The design may be varied to meet the individual needs.

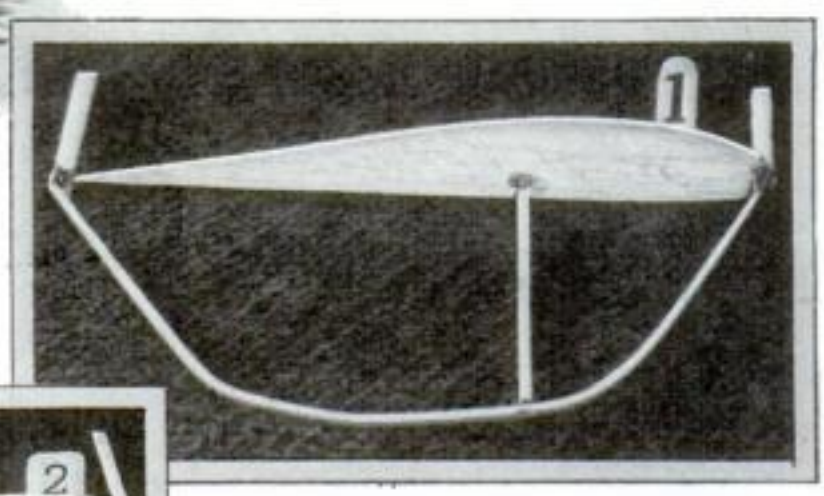
IN THAWING a frozen water pipe with a blowtorch, always start at the faucet end and work towards the meter. An electric reflecting heater is a safe and excellent substitute for the blowtorch. The radiant heat given off is easily focused and it quickly warms the frozen pipe.

Better Ways to Build Wings *for* Model Airplanes

Builders of model airplanes will do well to lay particular stress on wing design.

fighting the model plane's greatest enemy —weight. Some designs have failed because the designer sacrificed strength in his effort to eliminate weight, but great advances have been made, and model builders should be familiar with them.

Wings for light indoor endurance models, which are usually covered on one side only, can be dismissed with a few words. The usual construction is shown in Fig. 3. Its strength lies in its leading and trailing edges, which consist of two duplicate balsa spars, while its ribs are balsa strips of about 1/32 in. square, cambered to suit and cemented to the tops of the spars.



Two common types of wing tips, bamboo (Fig. 1) and ordinary thread (Fig. 2).

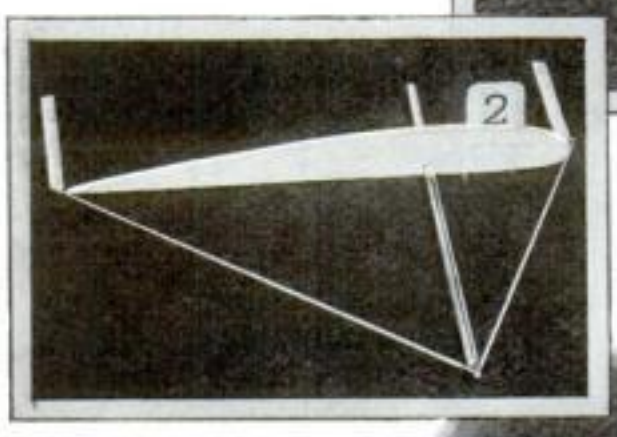


Fig. 4. The lightest type of wing construction. This design lends itself well to further experimentation.

The tissue covering is glued to the ribs as well as the spars. The wing's shape is maintained not only by the tissue covering, but also by the wing clips which hold it in place on the motor stick.

In designing and constructing wings for out-

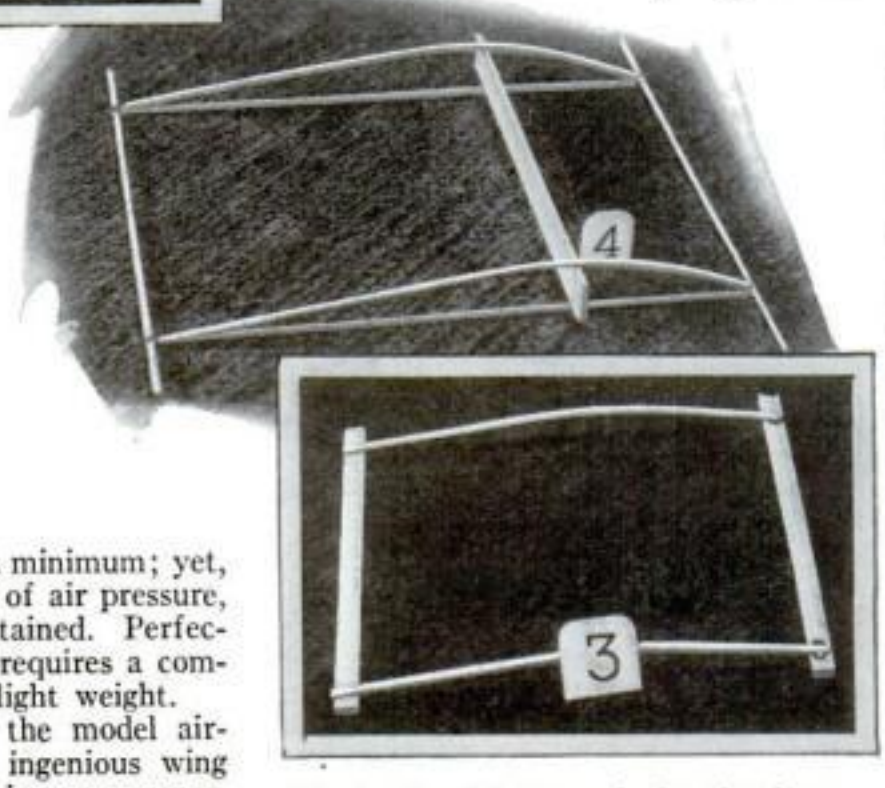


Fig. 3. The plain type of wing that is covered on one side only. Used on indoor models.

THE wing of a model airplane, being its main supporting surface, should be given the builder's utmost care in design and construction. As it is often the largest part of a model, it must be designed so that its weight will be at a minimum; yet, as it receives a maximum of air pressure, its strength must be maintained. Perfection in wing construction requires a combination of strength and light weight.

During the growth of the model airplane, many unique and ingenious wing designs have made their appearance. Practically all of these are the result of

door models, whether twin-stick, fuselage, or the so-called "flying scale models," three factors have to be considered—strength, weight, and form. Such wings, because they are covered on both sides, must be properly formed in respect to air resistance, drag, vacuum, and lift.

Experimentation has proven that the Clark-Y rib form is best for general use on models. All illustrations used in this article, with the exceptions of Figs. 3 and 4, have the general form of this type. It must be understood that the designation "Clark Y" refers to the outside form of a wing from leading to trailing edge, or as the wing looks when covered, and that

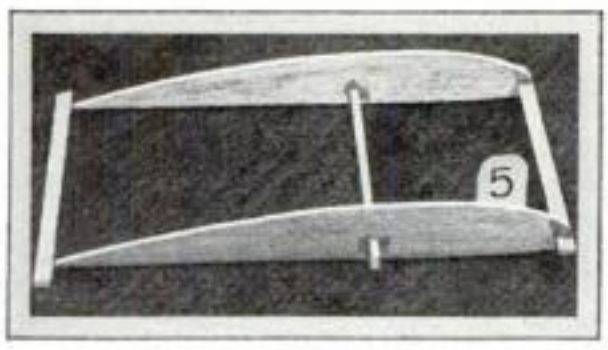


Fig. 5. This type of wing rib is strong but should be avoided because it is too heavy.

it has nothing to do with the means by which that form has been gained. The wings marked *1, 2, 5, 6, 7, 8, 9,* and *10* (and bearing corresponding figure numbers) are all Clark-Y forms. While these various ribs may look different, due to the fact that their excess weight has been removed in varying ways, their outside forms will give the same appearance to the wing when covered.

In the past, ribs were solid, as is shown in Fig. 5. It soon became apparent that such a rib contained an excess of material, and in an effort to lighten them, the ribs were cut out in various forms. A razor blade is used for cutting out the straight designs. The circles, however, are punched with the eraser ferrule of a common lead pencil, as shown in Fig. 6. The eraser is removed, and its small, round holder is slowly pressed into the wood.

How the ribs are cut out and their excess wood is removed depends upon the general position of the spars and the type of wing construction. All the wing sections

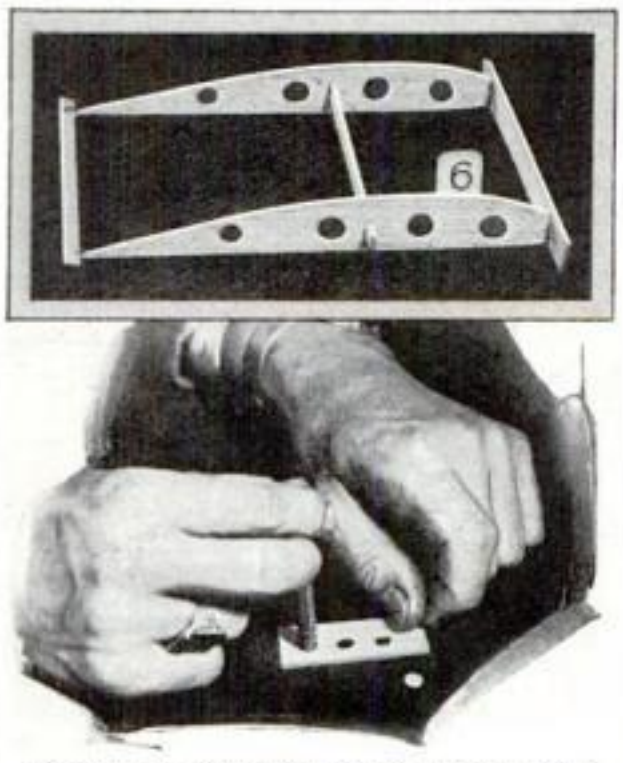


Fig. 6. An eraser ferrule on a lead pencil can be used to punch holes in balsa ribs.

have proved successful, and each merits discussion.

5. Disregarding its rib, which was left solid for illustrative purposes only, this is one of the strongest of wing designs. The leading, trailing, and center spar are of the same size. The leading and center spars fit into notches cut into the rib in order that the outer form of the rib will not be changed. The center spar is at right angles with the bottom edge of the rib, while the other spars are parallel to it.

6. This construction has ribs with four holes cut into each for lessening the weight. A trailing spar is cemented parallel to the bottom edge of the ribs, and a center spar of the same size passes through each rib but is at right angles to the bottom edge of the rib. Cement is applied at each rib. The leading spar is the largest. The ribs are cut off at their front end, and the spar, rounded to the form of the

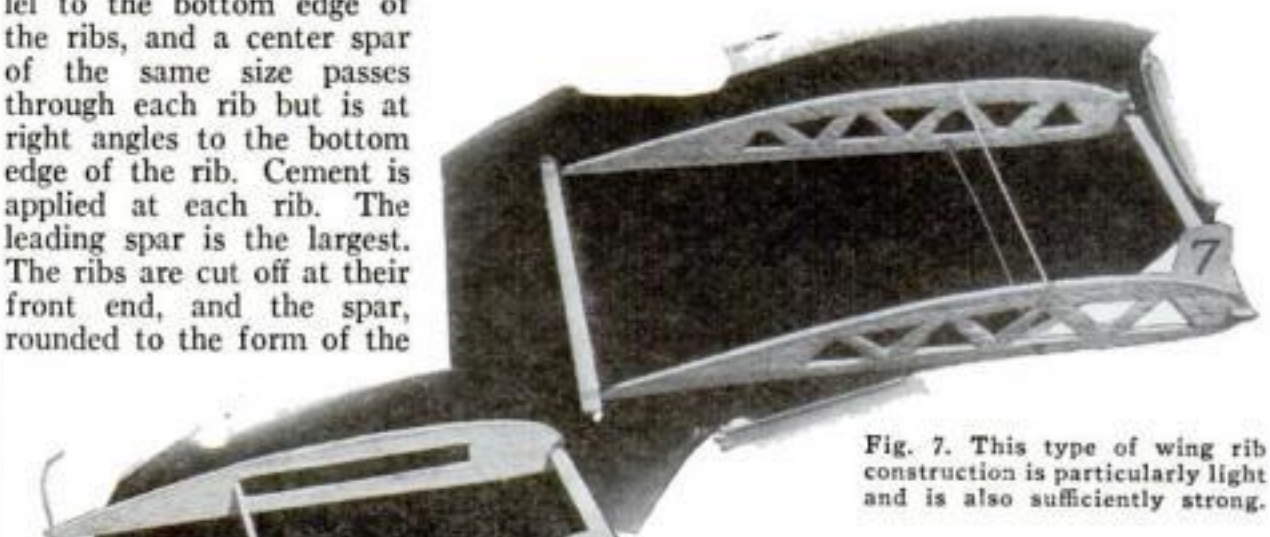


Fig. 7. This type of wing rib construction is particularly light and is also sufficiently strong.

Fig. 8. Thread is used for the trailing edge of the wing in this unusual design.

removed part of the rib, is cemented to each rib. While very strong, this construction is excessive in weight.

7. The ribs have seven triangles cut into each. The leading and trailing spars are alike. The top and bottom center spars are of thread, cemented to each rib. This is very light construction but with sufficient strength for the average model.

8. The ribs have a long slot removed in each. The leading and center spars are of the same size, cemented respectively parallel with, and at right angles to, the bottom edge of ribs. The trailing edge is of thread, cemented to each rib. This is strong construction, but useless if rubber bands are used for fastening the wing to the fuselage.

9. Two large holes are cut in each rib. The leading and trailing spars are the same size and cemented parallel to the bottom edge of the ribs. Very light balsa center spars are cemented into grooves cut in the top and bottom edges of the ribs. These can be as small as 1/32 in. square. This is a light and strong arrangement.

10. In this well-finished, strong construction, the ribs are cut out as shown, and the trailing and center spars, each of the same size, are cemented to each rib. The front end of each rib is then cut out in a V-form, and a square leading spar is cemented into each V. When the cement is hard, the protruding corner of the leading spar is rounded with sandpaper.

It must be remembered that all these spar arrangements can be used with any of the ribs shown, and the builder will do well to experiment with various combinations.

Figure 4 is a type of wing and rib construction that the writer feels should open new fields of experimentation. Because of its pointed nose effect, this cannot be classed as a Clark-Y rib, but its performance is remarkable, and the construction is of the lightest. The leading and trailing spars, as well as the top and bottom rib formers, are of strip bamboo, while the center spar is of 1/32-in. sheet balsa, its width being whatever the width of the rib is at its widest point. An effort to construct this design out of nothing but balsa would prove most interesting; such a design would have a promising future in wing construction.

The wing of a plane should be symmetrical in design from all points. Sharp, straight edges or blunt ends are as undesirable for speed as they are for appearance. This factor should be applied not only from leading to trailing edge, but also from wing tip to wing tip. For this reason, few wings end bluntly with the outer rib; the best designs are finished off in a graceful wing tip. Figures

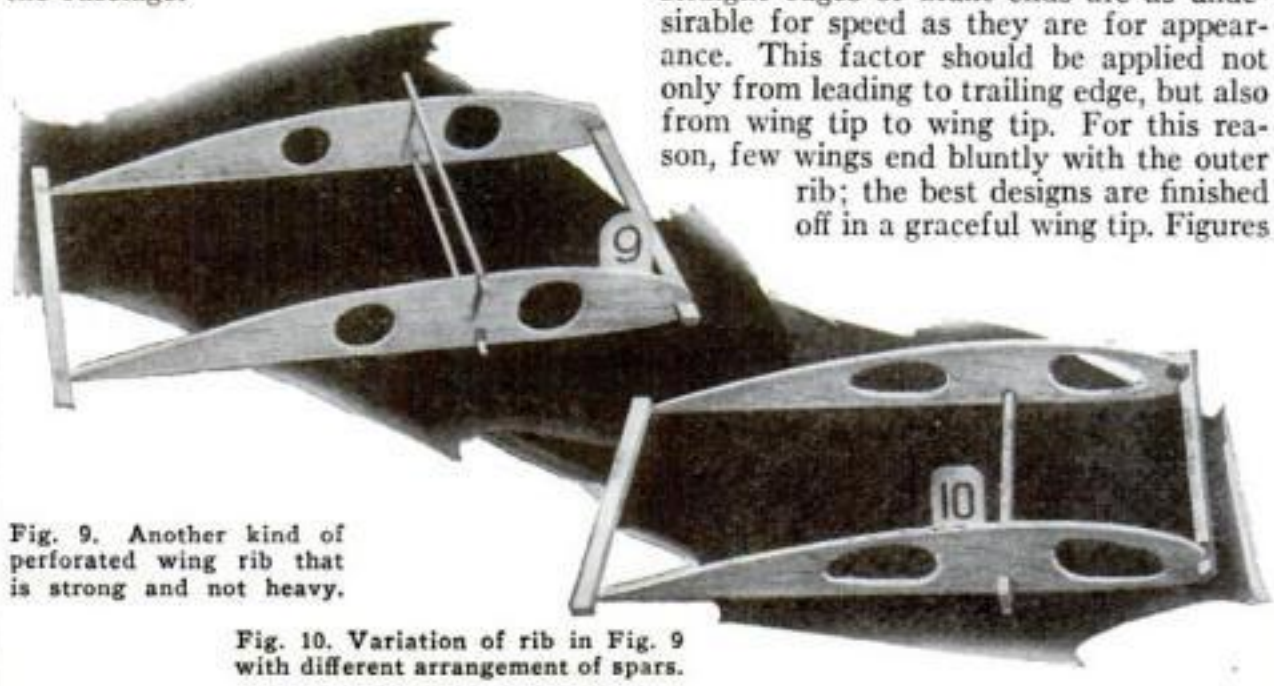


Fig. 9. Another kind of perforated wing rib that is strong and not heavy.

Fig. 10. Variation of rib in Fig. 9 with different arrangement of spars.

1 and 2 show two popular types of wing tip finish. The first is the bamboo tip. Note that the ends of the leading and trailing spars are cut to match the angle of the bamboo at the point where they are cemented together, and that the center spar is tapered from the outer rib to the width of the bamboo at the point where it is cemented to it. When covered, the wing gives the appearance of a gradual slope to its wing tip.

Figure 2 gives the same general appearance, except that the wing has a pointed tip. The leading and trailing spars are tapered, as in the first case. Thread is used in place of the bamboo, and the center spar is tapered to meet it. This construction is far lighter, but not quite so strong, though repairs are easier to make. With the bamboo, the tip can be made round, semiround, as in Fig. 1, or any other desired shape simply by bending the bamboo, but with thread the final form of the tip must take the appearance of straight lines.—EDWIN T. HAMILTON.

The best and easiest ways of covering airplane model wings will be described in a following article.

AUTOMATIC CONTROL FOR A FURNACE DAMPER

FULL automatic control of drafts on steam heating plants having a clock mechanism and pressure arm for opening and closing the check draft usually can be obtained by placing a link between the pressure balance control arm and the handle of the flue damper, as illustrated. This simple addition will cause the clock and pressure arm to close the flue damper at the same time that it shuts off the check draft and to open the damper when the draft is opened.

The link can be made from any piece of scrap metal stock and the pivots may be loose fitting rivets or nuts and bolts.

It may be necessary to fasten an extending arm on the handle of the flue damper if one does not already exist.—B. G. S.

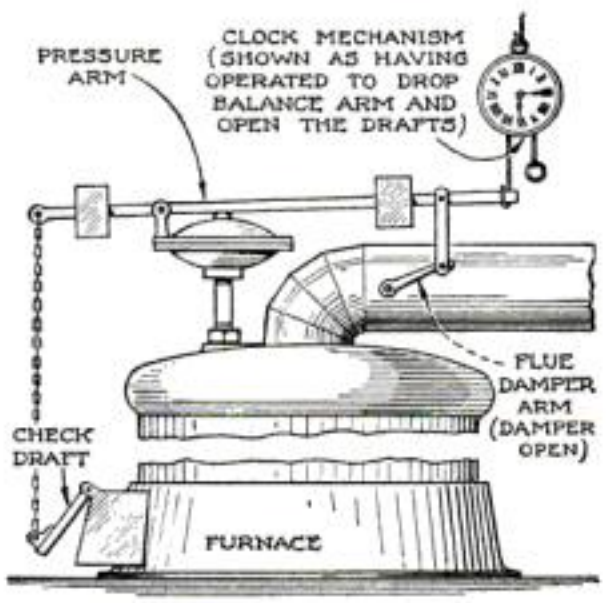


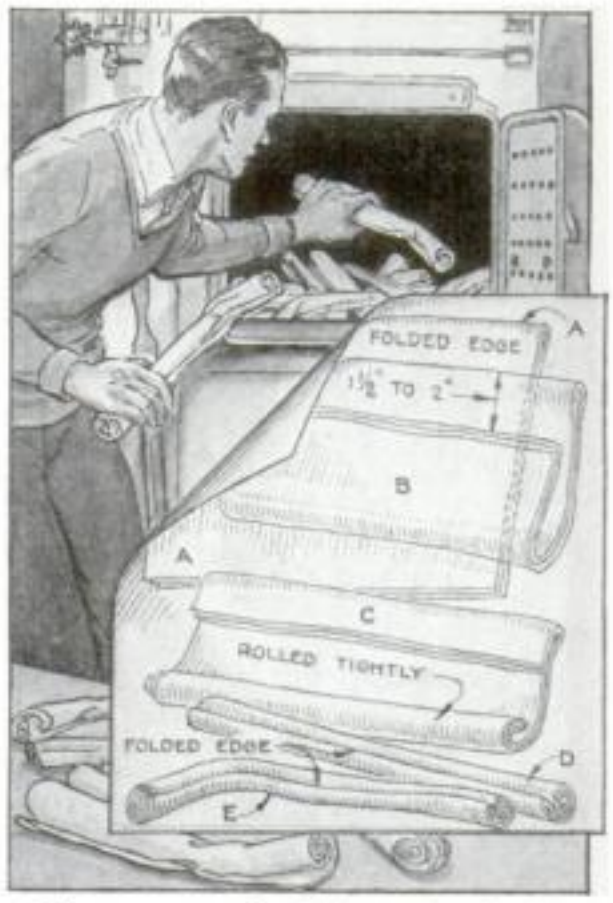
Diagram showing how the link is connected between the damper and the pressure arms.

STRANGE as it may seem, there is no relation between japan drier and baking japan. The former is added in small quantities to hasten drying while the latter is baked on a surface to give a beautiful enamel finish.

USING OLD NEWSPAPERS INSTEAD OF KINDLING

OLD newspapers, being made from wood, are well adapted for use as kindling to start coal fires. The writer has used nothing except paper kindling for two years and has found it entirely satisfactory.

From four to six (or more after you have had a little practice) double sheets of newspaper are assembled and folded into fourths as shown at *A*. Next, the loose edges are lapped lengthwise to within 1½



Old newspapers, if rolled as shown in these diagrams, can be used to start coal fires.

or 2 in. of the folded edge, and the papers are rolled toward the folded edge as tightly as possible (steps *B*, *C*, and *D*). The cylinder thus formed is crimped by bending it away from the folded edge as at *E*, causing the tightly rolled tube to keep its shape. After one becomes accustomed to folding the paper, these kindlings may be formed as rapidly as splitting wood.

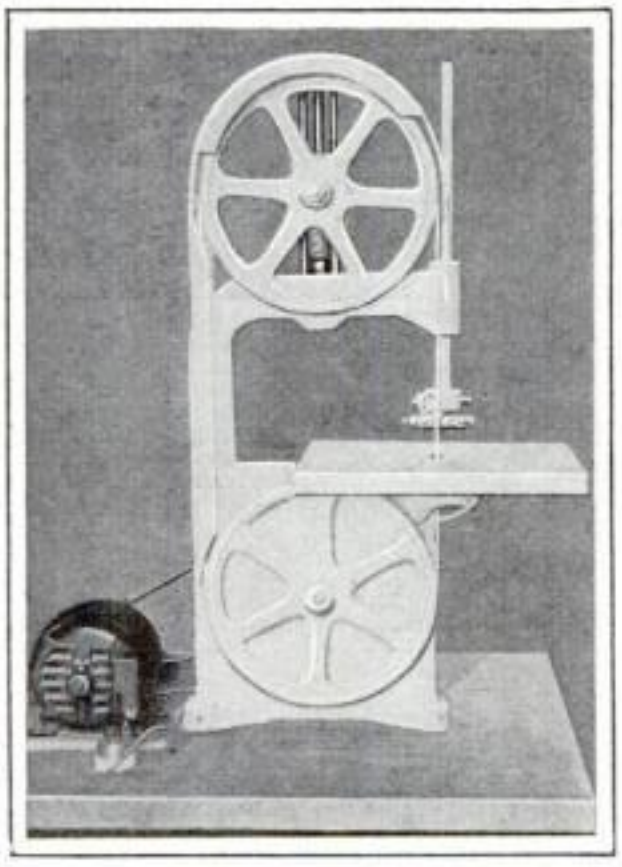
To start a fire, lay crumpled paper in the usual way and place from eight to twelve of the kindlings crisscross on top. When the paper rolls are aflame, they will readily ignite coal.—F. A. ST. JOHN.

FILLING CORNER CRACKS

CORNER cracks in plaster walls are a common blemish in many homes. In addition to being unsightly, they are extremely hard to fill satisfactorily with trowel or putty knife. The best way is to use a coarse brush, such as a paste brush. The patching plaster is mixed to the consistency of a thick paste and is then brushed into the crack until it is completely filled. After drying a little, the excess plaster may be scraped off. The result will be a clean job that will last indefinitely if there is no further spreading or settling of the walls.—ROBERT ROAT.

A GRAIN of salicylic acid added to a glue size tends to keep the mixture "sweet."

DOCTOR MAKES PATTERNS AND BUILDS COMPLETE BENCH BAND SAW

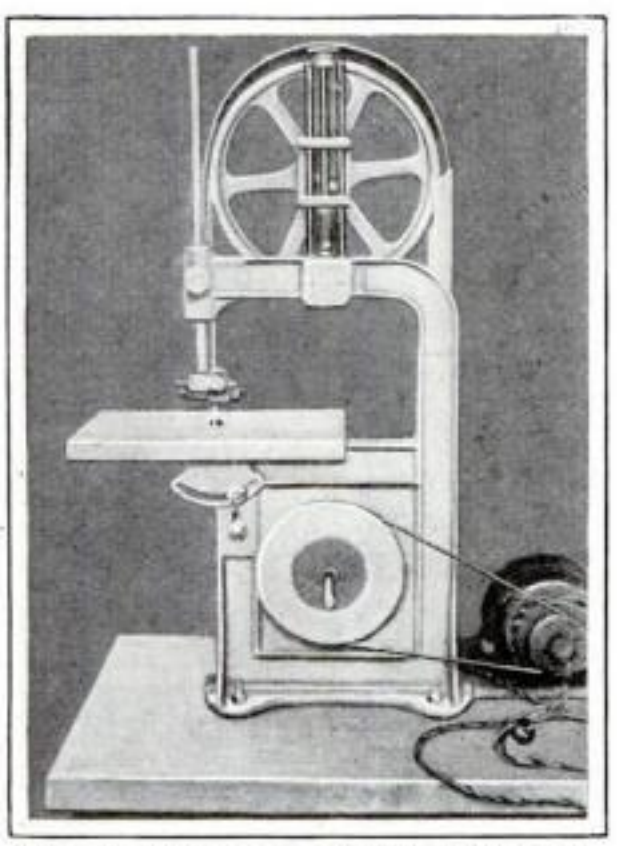


This band saw has 12-in. wheels with a 1-in. face; they are 21 in. apart, center to center.

WHEN L. St. John Hely, M. D., of Richmond, Calif., wants a new machine for his home workshop, he designs and builds it himself. His latest achievement is the small band saw illustrated—an unusually efficient machine with 12-in. ball bearing wheels turning 600 R.P.M.

The backing wheel and guide for the saw blade are adjustable. The table tilts and is also adjustable up and down, since the quadrant is clamped on a block which slides vertically.

After making drawings for the saw, Dr. Hely prepared the patterns on other home-made machines and had them cast at a railroad foundry. He did all the machine work in his garage workshop except boring the holes in the wheels, which he had done in a machine shop.



The wheel guide rods are ½ in. round steel, but the saw-blade guide rod is ½ in. square.

PERNICIOUS ANEMIA CURE WINS $10,000 AWARD

(Continued from page 31)

the importance of Dr. Minot's contribution, two facts should be remembered. First, Dr. Whipple did not apply his discovery to human beings. Secondly, he never claimed that the treatment would be effective in pernicious anemia. His dogs had secondary anemia, caused by bleeding. Pernicious anemia cannot be induced in any known laboratory manner. Its essential cause is entirely unknown. Moreover, secondary anemia, while dangerous, is seldom fatal. Pernicious anemia nearly always is, or rather was, deadly. Until Dr. Minot perfected the treatment for human patients, the average life of a pernicious anemia sufferer, from the time the symptoms first became obvious, was from two to three years.

For years Dr. Minot worked tirelessly upon his blood investigations, keeping scrupulous records of all cases that came to his attention and making microscopic examination of the blood of all of his patients. After finishing his interneship at the Massachusetts General Hospital, he went to the Johns Hopkins Hospital in Baltimore, and for two years continued his studies there.

BACK again in Boston, he associated himself with Dr. James Homer Wright, distinguished pathologist. From him Dr. Minot learned something new about the probable cause of pernicious anemia. At the time, the generally accepted theory was that pernicious anemia resulted from poisons breaking up the red blood cells. Dr. Wright differed. The red corpuscles are made by the marrow in the bones. Dr. Wright held that pernicious anemia was caused by a tumor-like disease of the bone marrow, which prevented the blood cells from attaining their normal growth.

But what could be done about a tumor hidden in the bone marrow? Dr. Minot doggedly continued his studies. Practicing in association with Dr. Roger I. Lee, an experienced blood specialist, from 1914 until 1917, he tried the treatments then approved, among them operations to remove the spleen, and blood transfusions. In that three-year period, the two doctors had ninety-six pernicious anemia patients. Surgeons removed the spleens of nineteen of these sufferers. Forty-six of them were given seventy blood transfusions. In each case, the patient first improved, a condition known as a remission of the disease, and then relapsed again. This would occur two or three times, but finally every one of the sufferers died.

The turning point came in 1921, when Dr. Minot himself was taken seriously ill with diabetes. This was before the discovery of insulin, and he knew that the proper diet would be his only hope. Placing himself in the hands of an outstanding diabetes specialist, he followed his instructions to the letter. In fact, he became a diet enthusiast.

MEANWHILE, in 1922, insulin was discovered, and it saved Dr. Minot's life. Resuming his work with greater strength and energy than ever, he determined to try diets in pernicious anemia. He questioned all of his patients as to their eating habits, and found that only thirty percent of them ate normally. The majority of them, he discovered, had had an aversion to meat and green vegetables practically all their lives. In other words, their diet had been lacking almost entirely in protein.

About this time he came across a work entitled "The Newer Knowledge of Nutrition" by Dr. E. V. McCollum, the great vitamin expert. In this way, he learned for the first time that liver was rich in protein and in the vitamins that speed the growth of young animals. He also found that managers of zoological gardens *(Continued on page 123)*

PERNICIOUS ANEMIA CURE WINS $10,000 AWARD

(Continued from page 122)

who attempted to raise lion cubs on a diet of lean meat always lost them. The young animals contracted the bone disease known as rickets and invariably died. But if the cubs were fed liver, bones and fat, they grew into strong, healthy specimens.

If liver will strengthen the outside of the bones, Dr. Minot reasoned, why not the marrow inside? Just then, the results of Dr. Whipple's experiments were announced and Dr. Minot began to feed his patients liver, prescribing about one quarter pound a day.

All through 1924 he secretly treated ten patients in that manner. The blood count of some of them had been as low as 2,000,000 red cells per cubic millimeter of blood. By 1925, they not only were all alive, but their counts ranged from 3,000,000 to more than 4,000,000, which is close to normal.

TOGETHER with an associate, Dr. William P. Murphy, Dr. Minot quietly continued the treatment, increasing the liver dose to a half pound a day. Patients who were brought to the hospital dying from pernicious anemia, with the blood count down to one tenth of the normal and so ill that they could not eat at all, were fed liver in pulped form through stomach tubes.

Then, suddenly, in 1926, Dr. Minot, at a meeting of the Association of American Physicians, at Atlantic City, N. J., announced that forty-five pernicious anemia patients, treated by him and Dr. Murphy with the liver diet, had recovered.

Immediately thereafter, doctors in all parts of this country as well as all over Europe tried the new cure and found that Dr. Minot had not overstated its efficacy.

Since then, Dr. Minot and his associates have succeeded in separating the chemical in liver that cures pernicious anemia. Now, it may be taken in powdered form, dissolved in orange juice or other liquid. Recently, Dr. Whipple and his assistants have done the same thing so far as the chemical that fights secondary anemia is concerned.

In this way, it has been possible to concentrate and purify chemical elements that represent only three percent of the entire liver weight, and yet contain eighty percent of the potency of the liver. This so-called liver fraction has been in use in many hospitals.

BORN in Boston, Mass., in 1885. Dr. Minot was graduated from the college of Harvard University in 1908 and from its Medical School in 1912. His interneship at the Massachusetts General Hospital lasted one year, after which he was connected with the Johns Hopkins Hospital in Baltimore, Md., until 1915. From then until the present, he has been connected in various capacities with the teaching staff of the Harvard Medical School and the medical staffs of the Massachusetts General Hospital and the Huntington Memorial Hospital in Boston, where he became chief of the medical laboratories in 1923. At present, he is professor of medicine at Harvard.

Dr. Whipple, born in Ashland, N. H., in 1878, was graduated from Yale University in 1900 and from the Johns Hopkins Medical School in 1905. From 1905 until 1907 he was connected with the Ancon Hospital in Panama, and in 1908 with the Bay View Hospital in Baltimore. After that, he served on the teaching staff of the Johns Hopkins Medical School until 1914, when he accepted the post of professor of research medicine and director of the Hooper Foundation for Medical Research at the University of California. In 1921 he was appointed dean and professor of pathology in the School of Medicine and Dentistry of the University of Rochester.

Cuts—and Short Cuts—on

A Motorized Jointer

By DONALD A. PRICE

Accurate beveled joints are as easy to make with a bench jointer as plain square edges.

WHILE the name of the jointer indicates its use in planing the edges of stock that is to be joined, its practical utility to the home craftsman is far more extensive.

Among its specific uses are: accurately truing up edges of boards for gluing up table tops and other wide pieces; planing the surfaces of boards of any width up to the capacity of the machine; planing bevels; cutting open and "dropped" or stopped chamfers; cutting rabbets for glass in picture frame moldings as well as shaping the face of the molding (providing it consists of plane surfaces); and in addition some "stunt" uses that simplify many cabinetmaking operations.

As in hand planing, the first operation in bringing a piece of work to size on the jointer is to prepare a true side and a square edge. Pressing the work directly downwards on the table, make successive *light* cuts until one side or face is planed true. Then run the work through to square up the edge, keeping the true side against the fence. This operation is shown in Fig. 1. Notice that there is a safety guard on the machine and that *it is being used*.

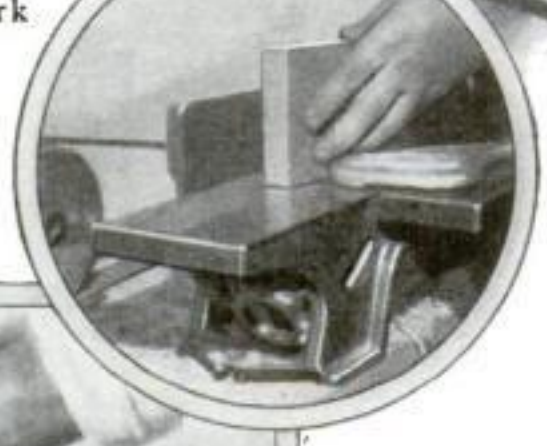


Fig. 1. After one side or face of a board has been planed, that side is pressed against the fence, and one edge is trued as at the right.

Another safety precaution is to shift the hands holding the work as it is fed forward so that they are never over the knives or in danger of going into them if either hand should slip. Also, never make adjustments without first shutting off the power. Place a switch in a convenient place near the machine so that it can be readily shut off. It may be a "through" switch on the motor cord or, better yet, a "throw" switch mounted on the motor or the base.

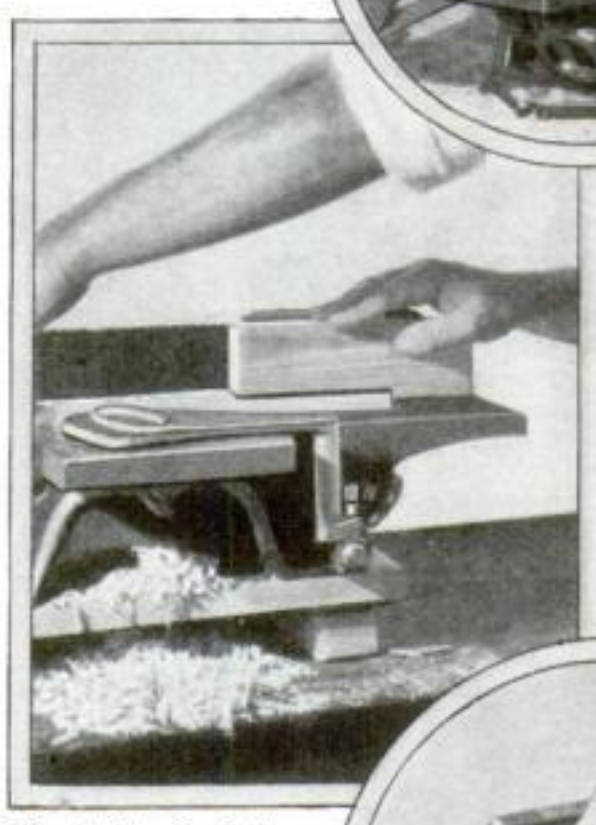


Fig. 2. Small, short, and thin work should be pushed through the jointer with the aid of a notched block.

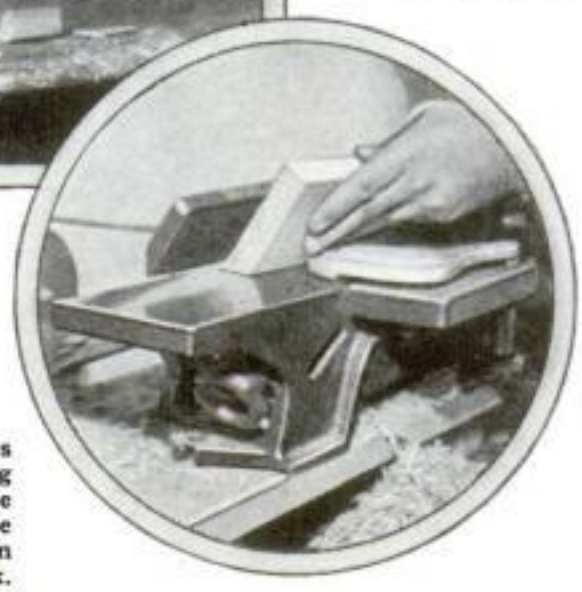


Fig. 3. Cutting bevels with the fence slanting inwards. This is the preferred method, as the tilted fence helps in holding down the work.

When starting up the jointer—and this is a general rule for all machines—pull the belt over by hand to see that there is no interference before turning on the power. When running through work of small cross section or work that is extremely thin, use a notched block as shown in Fig. 2 to push it through.

The procedure in

cutting beveled edges is substantially the same as cutting a square edge except that the fence is tilted to the proper angle. Notice in Fig. 3 that the fence is set to bevel inwards instead of outwards. This always should be done when the construction of the machine will allow it, since the upward thrust of the cutters is then partially taken by the fence, making it easier to hold the work down. All edges which can be planed with the grain by means of this set-up should be run through the machine. Then, if a perfect finish must be had on the remaining edges, the fence can be set slanting outwards and the work turned end for end and run through in the opposite direction in order to cut with the grain.

THE set-up for rabbeting is shown in Fig. 5. The front table is dropped below the rear table the depth of the cut desired, and the fence is set the width of the cut away from the end of the knives.

To cut an open chamfer, drop the front table to make a coarse cut and then set the fence at the 45° bevel as shown in Fig. 4. Feed slowly until the end of the piece is stopped by the block clamped to the rear table. If this does not give as long a chamfer as desired, an L-shaped piece or hook such as shown in Fig. 7 can be added to the rear table in order to allow the end of the piece to travel beyond the end of the table. This use of the stop will insure all chamfers being cut to the same length.

When a "drop" chamfer must be cut, lower the rear table down level with the front table. Set the tables in line by using a straightedge with a portion cut out to clear the knives. A block or a hook used as shown in Figs. 6 and 7 respectively is clamped firmly on the front table. The cut is started by slowly sliding the piece down the fence onto the machine, all the time pressing backwards to keep the end of the piece firmly against the stop on the front table. When the full depth of the cut is being taken, feed forward to a stop set on the rear table to give the desired length to the chamfer.

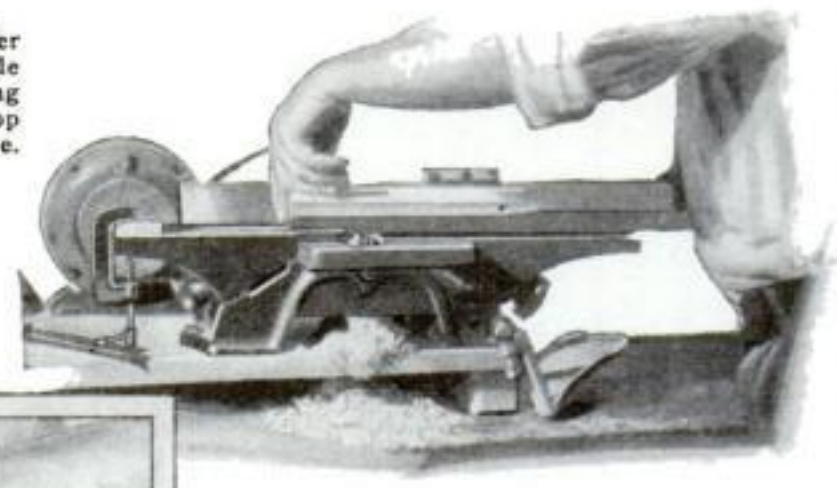
A CURVED taper such as at *C*, Fig. 8, can be cut by setting the table as shown in Fig. 10. The front table is dropped as low as possible and the rear table raised so that the head just starts to cut in position *A* of work. Feed forward, keeping the foot of the leg always pressed down firmly on the front table and tilting up the top of the leg till the foot end is not less than ¼ in. from the gap when the cut is stopped. This results in a gently increasing curve towards the end of the leg as shown at the bottom of Fig. 10. Cut the work off at *X* if a simple taper is desired, or finish the end as shown in dotted lines if a foot effect is called for.

A straight taper may be cut with exactly the same set-up as used in Fig. 10 for cutting a curved taper. The difference in procedure lies in keeping the cut pressed down on the rear table and guiding and gaging the cut entirely by this. You will find that the foot of the work lifts up slightly from the front table after the cut is started and that the cut will be straight. A few experiments will quickly show just how these taper cuts are made.

The modernistic leg pictured at *B* in

Fig. 4 *(at right)*. An open chamfer is cut by dropping the front table to give a coarse cut and setting the fence at a 45° angle. A stop block is clamped to the rear table.

Fig. 5 *(below)*. In rabbeting, the front table is dropped below the rear table to the depth of the desired cut. The fence gages the width of the rabbet.



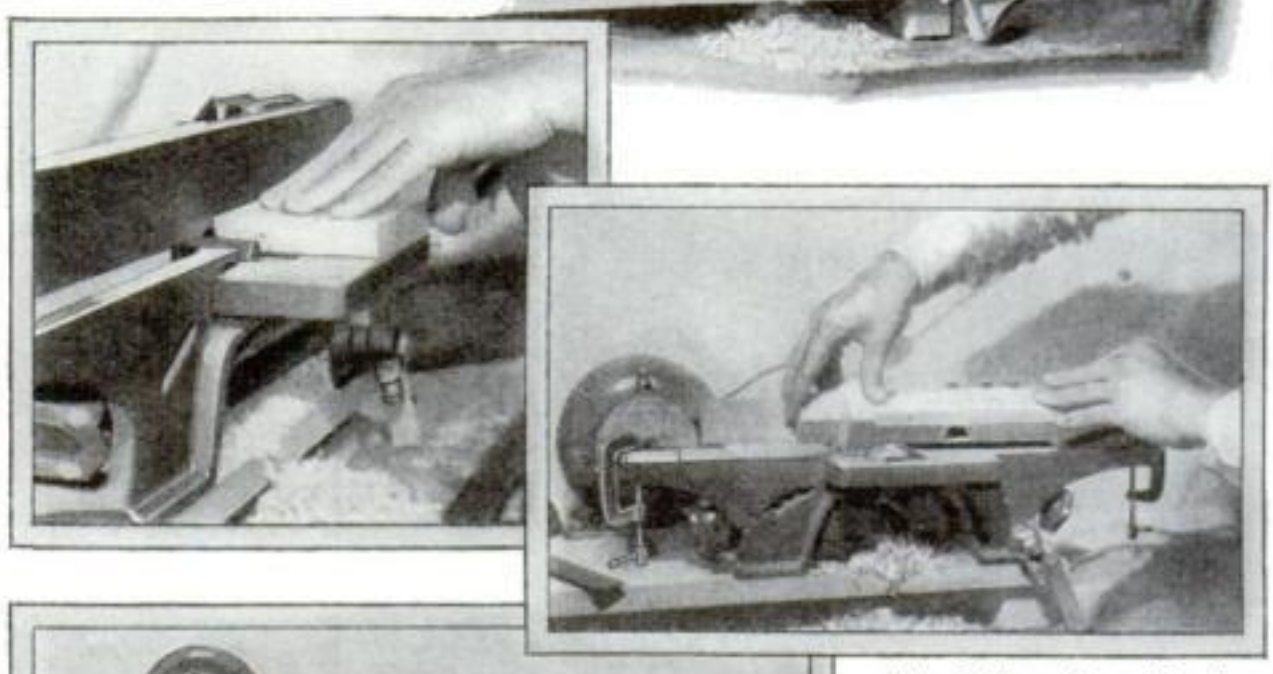


Fig. 6. To make a "drop" or stopped chamfer, the cut is started by sliding the piece slowly down the tilted fence.

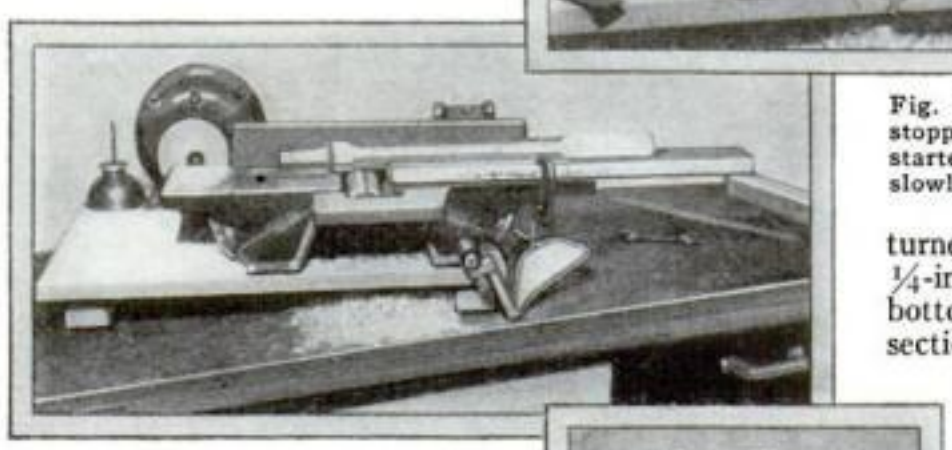
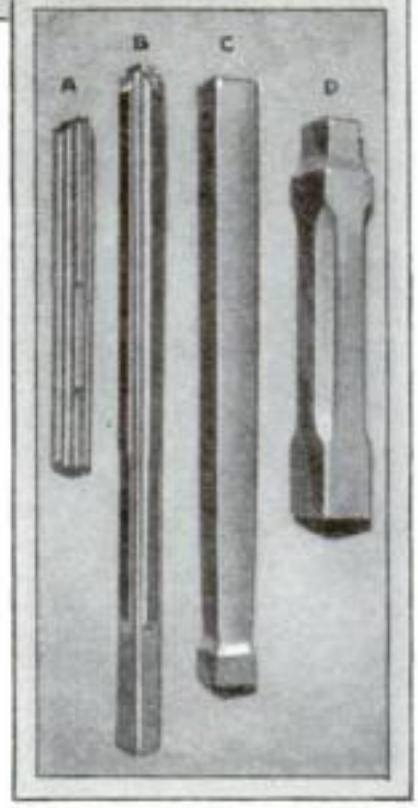


Fig. 7. A set-up for "drop" chamfering which shows the use of a wooden hook as a gage for starting each cut.

Fig. 8 *(at right)*. Examples of work.



the photograph of Fig. 8 and the drawing in Fig. 9, is made entirely on the jointer save for the block on the top, which is cut out separately and glued in place. A piece of wood 1½ in. square is trued up. Then the jointer is set to cut a ¼ by ½ in. rabbet, and the piece run through four times in one direction, when it will look like section *A*. It is now turned end for end and run through four times more to obtain section *B*.

The fence is now moved to the right side of the table and a ¼-in. cut started at the top *C* of the leg. The piece is again turned end for end and a ¼-in. cut taken from the bottom up to *D*, giving section *F*. The front table is raised to make the cut only ⅛ in. deep, and more is taken off the rib up to *E*, finally giving section *G*. When the 5/16 by ⅝ by ⅝ in. toppiece is glued and bradded on, the leg is complete.

The dimensions are given merely for descriptive purposes. By changing the depth and width of the cuts, varying effects such as illustrated can be obtained. Another effect obtained by changing the finishing of the head is shown at *A*, in the photograph of Fig. 8, and at the extreme

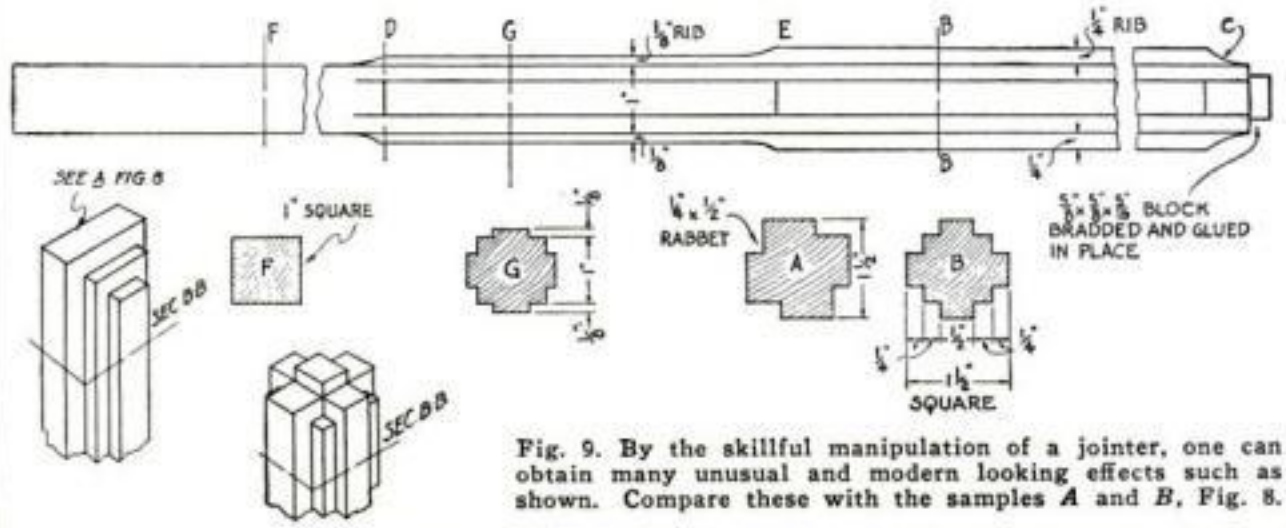


Fig. 9. By the skillful manipulation of a jointer, one can obtain many unusual and modern looking effects such as shown. Compare these with the samples *A* and *B*, Fig. 8.

left of the details illustrated in Fig. 9.

The foregoing cuts and specimens of work are by no means exhaustive and are given only as an indication of what the home workshop enthusiast can do by the ingenious use of his motorized jointer.

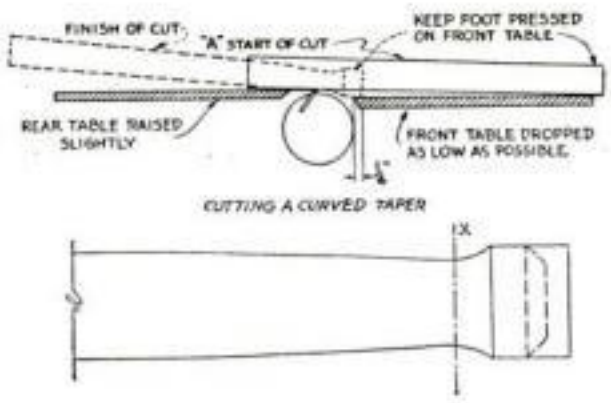


Fig. 10. How a curved taper is obtained. The same set-up may be used for straight tapers.

For information on setting up a jointer and sharpening and adjusting the cutter blades, see Mr. Price's preceding article, "How to Get the Most Out of Your Bench Planer" (P. S. M., Jan. '31, p. 93).

COVERED WAGON MODELS ARE NOW POPULAR

An accurate, beautifully finished scale model of a covered wagon built by Harry Streich.

HAVE you considered building a covered wagon model? It is a good deal simpler than a stagecoach, yet in its way it is more symbolic of that dauntless American spirit which led so many hardy pioneer families through the perils of their westward migration. To every real westerner the covered wagon represents courageous and successful pioneering, just as the clipper ship stands for New England's achievements on the high seas.

Many readers have already built covered wagon models with the aid of POPULAR SCIENCE MONTHLY Blueprints Nos. 118, 119, and 120 (see page 113). Among them is Harry Streich, of Marshall, Wis., who constructed the model illustrated above. He writes:

"I am twenty years old and enjoy reading POPULAR SCIENCE MONTHLY. I have also enjoyed building the models of the Baltimore clipper (Blueprint No. 92), which I put in a bottle and therefore have nearly everybody guessing how it got there; the *Santa Maria* (Blueprints Nos. 74, 75, and 76); and the covered wagon."

SCREWS can be started in places hard to get at by filling the slot in the head with beeswax, soap, or hard grease before inserting the screw driver.—O. S.

How to Install a Block Signal System on Your Model Railway

Where the special track contacts, lights, and switches should be placed—Problems of current control—Concluding article

By FREDERICK D. RYDER, JR.

Fig. 1. Once your control switches and signal lights are made, it is a simple matter to install the wiring.

AFTER you have completed the special block signal switches, the special signal lights, and the special track contacts as detailed in the two previous articles of this series (P. S. M., Dec. '30, p. 94; and Jan. '31, p. 86), you are ready to proceed with their installation on your own model railroad.

It makes no difference whether your railroad is "standard" or "O" gage; the same work has to be done in the same way. In fact, the only difference will be in the number of sections of track included in each block.

The blocks should be evenly spaced around the track circuit. At first glance it would appear better to have the spacing uneven because several trains of equal speed would be bound to stop in the blocks and thus give the system plenty to do. However, equal speed for several trains is never obtained. Even when all the locomotives are of the same type and each one hauls the same number of cars, slight differences in brush action will result in considerable variation in train speed.

Assuming that there is one train which operates at a slower speed than the rest, it would be natural to expect this train to run continuously while the others trail along with frequent stops in the blocks. Actually this doesn't happen. On my own railroad one of the four trains I operate is notably slower than the rest, yet it often happens that this train stops in the blocks because of the delay caused by the others starting up, one after another, after they have all stopped in blocks back of the slow train.

The first problem is to determine the positions where you want the block signal lights. Naturally, they should be at points where they will appear to best advantage and give the most realistic effect.

If the track circuit includes an up-and-down grade, one block and its signal light certainly should be located at the bottom of the grade unless the grade is so steep that it is necessary to have the trains moving at the bottom in order to climb properly. Do not locate a block in the middle of an up or a down grade. On the up grade it will cause needless wear on the locomotives in starting the trains from a standstill on the grade. On the down grade it will be difficult to make the trains stop without having them coast past the block.

On my own model railroad, which is of "standard" gage, the number of sections of track comprising a block run from six to nine sections.

The best way to determine how long to make the blocks on your own model railroad is to find out how far the trains will coast after the current is cut off at the points where you wish to install blocks. Make your tests with the fastest train you expect to operate. When you have determined the actual length of coast at each point, add a couple of sections for good measure so that there will be no chance of a train's coasting clear through a block to the live track at the far end of it.

After you have determined the location and length of each block, use a hack saw blade to saw through the third-rail pins at each end of each block. This will save taking up the track to remove the pins. Figure 3 shows a simple way to saw through a third-rail connecting pin by the aid of a hack saw blade held in a pair of pliers.

The block signal system works only with trains that run in one direction. It could, of course, be made to operate in both directions, but an interlocking system arranged in this way would be exceedingly complicated.

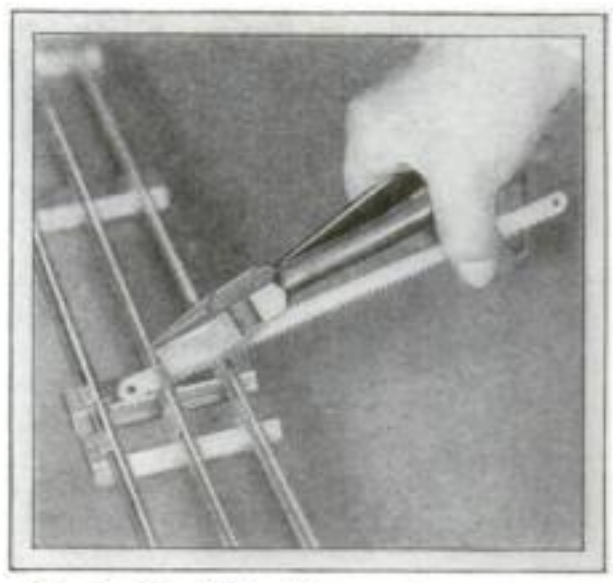


Fig. 3. The third-rail connecting pin must be sawed through at each end of each block.

Locate the solenoid-operated switches at convenient points near the far ends of the blocks and place the block signal lights to the right of the track at about the same points. A special track contact should be placed in the section of track just beyond each block.

Now study the diagram of Fig. 2 (which is also shown pictorially in Fig. 1) and proceed with the wiring, using ordinary bell wire. Note that Fig. 2 shows only one block, but as all blocks are wired alike, you will have no trouble if you follow the diagram given.

You will note that one wire is marked "to track contact of next block." When the wiring is completed, you will find that two wires lead to each track contact. Consequently, when a locomotive passes over a track contact, it actually causes two solenoid magnets to operate. One acts to cut off the current from the block over which the train has just passed,

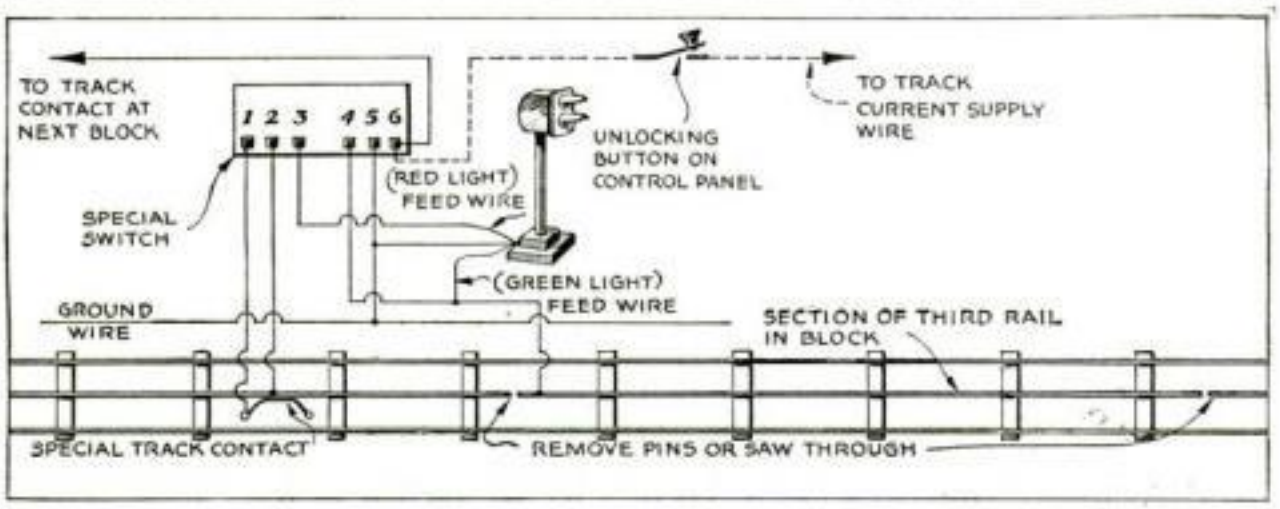


Fig. 2. The wiring diagram. While the connections for only one block are shown, every block is wired the same. The ground wire goes to the grounded running rails by way of a master switch.

and the other restores the current to the previous block.

All the wires marked "ground" must be connected together and to the grounded running rails through a single-pole, single-contact switch. When this switch is open, the entire block signal system is inoperative, and trains can be operated in either direction around the track just as though there were no block signal system installed.

When the wiring is completed, set each one of the special switches by hand so that the green lights burn. Then start a train around the track and note if the lights function as they should. The green light at any block should go out and the red light should flash on as the train passes over the contact at the end of the block. The red light should stay lighted until the train passes over the contact at the end of the following block; then it should go out and the green light should flash on.

IF THE lights function as they should, try two or more trains, making sure that the trains start from the terminal one after the other so the blocks will work.

If you stop any train by throwing a switch to cut off the current from that portion of the track on which it is running, the train immediately behind it will stop in the preceding block, the third train will stop in the block before that, and so on until all the trains are stopped in blocks. Then when you start the train you have stopped, the others, one after another, will proceed.

Assuming that you have by hand set all the switches so that the green lights are shining, indicating all clear for the full circuit of track, this all-clear condition cannot remain after you have once operated a train around the track. No matter where it is stopped, the block over which it has just passed will shine red. Therefore if several trains are running and you send one into a siding or into the terminal, the other trains will be held up in the preceding blocks.

THIS peculiarity is an advantage, however, for it gives time to get a train safely shunted into the proper siding in the terminal without having all the other trains rushing in to hinder the operation.

Obviously, a means must be provided to unlock the block just preceding the stretch of track which contains the track switch leading to the terminal. The way to accomplish this result is to connect a push button so that you can send current through the unlocking solenoid magnet of the switch that controls the block preceding the terminal. The push button should be wired direct to the solenoid and the source of current supply without regard to the other wiring. Figure 2 shows such an unlocking button wired in.

An unlocking button can, of course, be fitted for each of the blocks, although in normal operation you will find little use for these buttons except as outlined.

Provided that you build the special block switches carefully and install the special track contacts with equal care, I can promise that you will have practically no trouble with the operation of the system.

The special block switches will never need any attention whatever. Do not, under any circumstances, lubricate them;

A definite program for getting ahead financially will be found on page four of this issue.

A definite program for getting ahead financially will be found on page four of this issue.

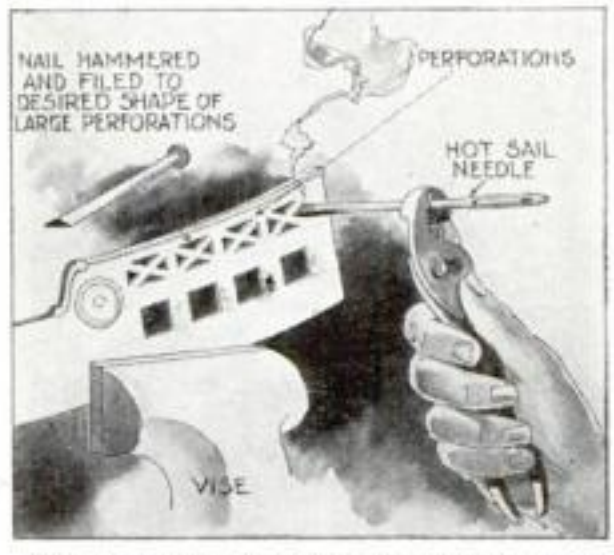
they should be operated absolutely dry. It isn't a bad idea, however, to fit simple pasteboard covers over them, because I suppose that several years collection of dust might cause them to stick.

In the normal operation of the trains, you will find that there are times when all trains are running and also times when only one train is running, the others for the moment being held in the blocks. It is obvious that no possible setting of a single rheostat will take care of such a wide difference in load. If you set it for several trains, when all but one are stopped in the blocks, the remaining train will go too fast, and so on.

The solution is to use as many different rheostats as there are blocks, arranging the wiring so that each rheostat controls one block and the track in front of it as far back as the next block. The block system prevents more than one train from operating on the track between any two blocks, therefore each rheostat will have to handle only one train at a time.

Note: Mr. Ryder will be glad to answer questions relating to special problems our readers may encounter in attempting to install an automatic block signal system on their own model railroads. Make your questions as detailed and specific as possible and address them to: Frederick D. Ryder, Jr., in care of POPULAR SCIENCE MONTHLY, *381 Fourth Avenue, New York.*

RED-HOT NEEDLE USEFUL IN SHIP MODEL WORK



Tiny perforations in ship model parts often can be made most easily by burning them in.

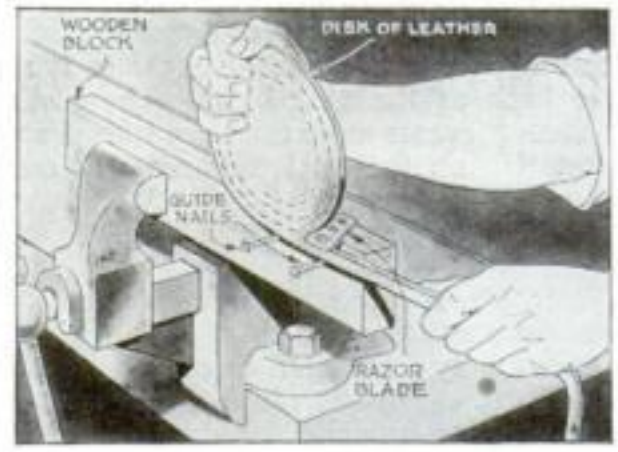
IN MAKING the bulwarks and handrails on the Barbary pirate galley model (POPULAR SCIENCE BLUEPRINTS Nos. 44 and 45), I used 1/16 in. thick three-ply wood instead of the press board suggested on the plans. However, in cutting out the necessary perforations, I experienced serious difficulty, as the wood would split and chip off in small pieces. Several pieces of plywood were spoiled before I hit upon the idea of burning in these perforations with a red-hot sail needle. The larger open-work designs were burned in with a large nail, hammered and filed to the shape desired.—ERTHA R. MEALS.

VARNISHES are often referred to as "long oil" or "short oil." The first type is generally slow drying, tough, and elastic, such as a spar varnish; the second has less oil, like a furniture or rubbing varnish.

HOW TO CUT LACES FOR LEATHER CRAFT WORK

FOR those who are doing the leather craft work recently described in POPULAR SCIENCE MONTHLY, the following wrinkle for cutting laces should be of value. Generally when making laces, the idea is to utilize the small pieces which accumulate. A piece 6 in. square can be made to furnish a lace over 6 ft. long by first making it circular and then cutting the lace in a long spiral.

A quick way to accomplish this is to use a safety razor blade fastened to the side of a pine block about 2 by 4 by 12 in.



Cutting a leather lace. For clearness the lace is shown larger than ordinarily would be used.

Let the razor blade project over the edge of the block for ½ in., and incline it slightly forward. Place the block in the vise with its top level with the top of the vise and drive a brad into the block opposite the front edge of the blade and as far from it as the width of the required lace. Place another brad 1 in. in front of, and in line with, the first brad so that it will act as a guide for the leather.

Start the spiral cut in the leather by hand for about 1 in. Then place the beginning of the lace between the razor blade and brad and draw the whole lace through.

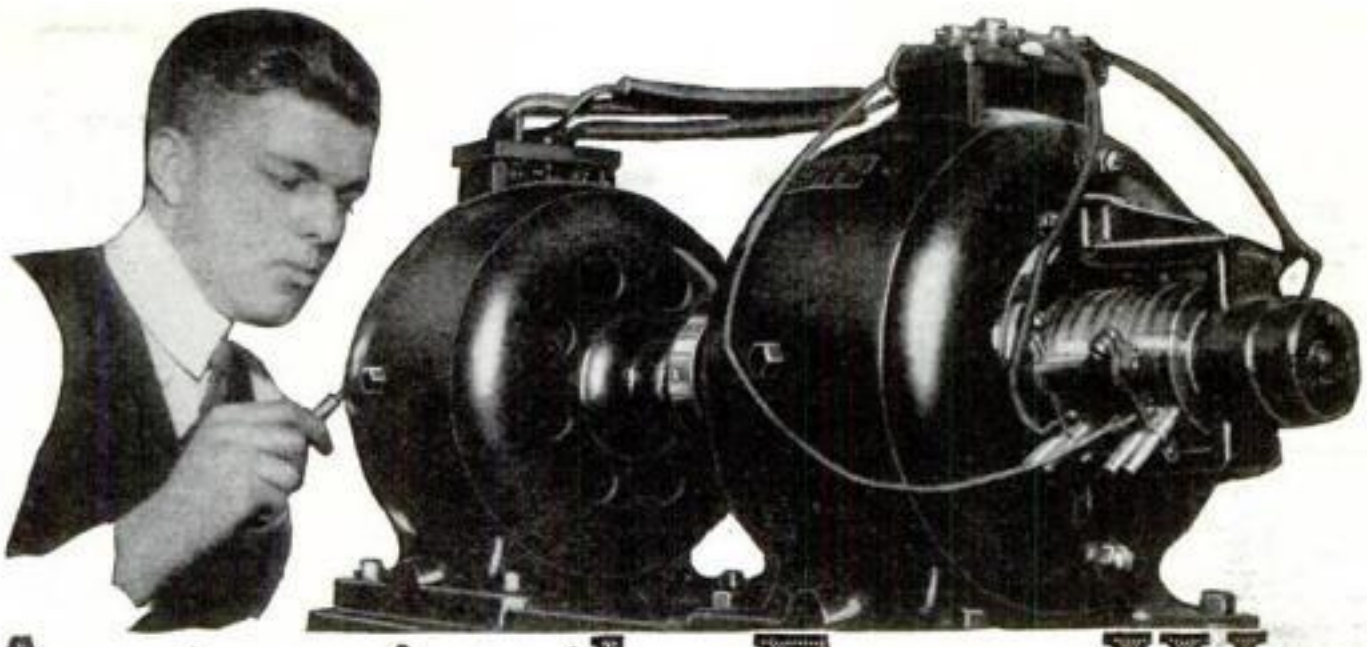
Any style razor blade may be used. The three-hole variety may be held with tacks driven through two of the holes, while the straight-backed kind may have the tacks at the back. If no razor blades are available, the idea may be utilized by using a keen penknife. In this case the block is not necessary, the knife being driven into the top of the bench and the brads set as before.—H. CALDWELL.

PAINTING FABRIC RUGS

IF FIBER or similar rugs are made of a plain woven fabric without knots or pile, it is possible to give them a durable painted surface in any reasonably light color by the following method:

Apply a priming coat mixed in these proportions: 5 lb. paste white lead, 1 ⅗ pt. raw linseed oil, ⅘ pt. turpentine, and 1 tablespoon drier. The white lead can be tinted with artists' oil colors or regular tinting colors.

When this is dry, apply two or three very thin coats made by thinning white lead with a half-and-half mixture of turpentine and high-grade floor varnish, and tinting to suit. Apply a final protective coat of the floor varnish alone.



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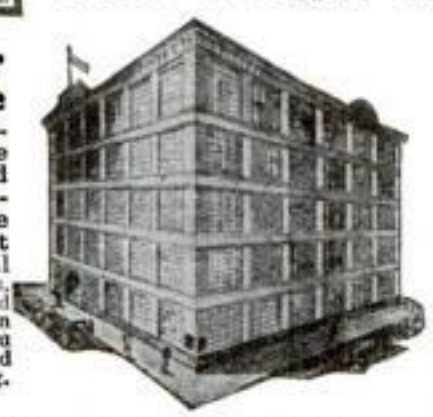

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CAN MEN STAND HIGH SPEED?

(Continued from page 43)

reached by Major H. O. D. Segrave at Daytona Beach, Fla.

All these records however, are left far behind by the airplane. Within the space of a single generation, speeds of three miles a minute have become commonplace in the air and men talk confidently of shooting through the sky faster than sound can travel!

Will the human body, so long used to traveling slowly, be able to adapt itself to such paces? Somewhere on the skyways, has Nature posted a speed limit beyond which it will be fatal for men to go?

I ASKED those questions of Dr. Harold J. Cooper, one of America's leading specialists in that rising branch of science which studies the effect of flying upon the human system, aviation medicine. Dr. Cooper is Assistant Medical Director of the Bureau of Aeronautics, Department of Commerce, in Washington, D. C. He answered my last question first, and in the negative.

"As far as we are able to tell," he said, "Nature has set no speed limit for the human system for straight and level flight. When you ride in a cabin plane, the body of air inside moves along with you. You feel no different when you are going fast than when you are going slow. You could move through space at a terrific pace without the slightest bodily discomfort.

"It is never straight forward speed that produces bad effects upon the human system. It is rapid acceleration in speed, sudden changes in altitude, and sharp turns. High speed planes will have to gain momentum gradually. In open-cockpit ships, sudden changes in pressure due to alterations in height cause the ears to hurt. But in a sealed cabin, changes in altitude would have no effect."

The greatest danger that results from high speeds, Dr. Cooper told me, comes from centrifugal force, driving objects away from the center of curvature. This force can knock out a pilot or passenger with the suddenness of a bolt of lightning.

At the National Air Races, last fall, there was a striking demonstration of the menace of this invisible power. As Captain Arthur Page, flying more than 200 miles an hour in the Thompson Trophy Race, rounded each pylon, the terrific centrifugal force of his turns jammed him down into the cockpit, forcing his steel seat farther and farther into the fuselage. And it did something far worse.

At every turn, it threw the blood down away from his brain. Pump as it would, for an instant, his heart could not drive the blood up against that force. When Captain Page leveled off on each straightaway, the blood rushed back to his head; when he banked around the closely-placed pylons, it rushed away. His life stream was churned up and down as though operated by a gigantic pump.

AT LEAST that is the theory advanced by experts to account for the unexplained accident in which he lost his life. They believe it was due to the repeated draining away of blood from his brain.

Test and pursuit pilots have reported the same effect when they pulled out of long and steep dives. Several years ago, when Lieut. "Al" Williams, then the crack stunt and racing flyer of the Navy, was practicing for the Pulitzer races in a tiny blue and gold biplane, he rounded a turn at 250 miles an hour and "passed out completely." Everything went black for an instant. The blood had been thrown violently away from his head and the result was momentary unconsciousness.

"We have a special name for that condition in aviation medicine," Dr. Cooper told me. "We call it 'cerebral anemia'—lack of blood in the brain."

At tremendously high speeds nothing in the world can overcome the harmful effect of centrifugal force upon the human blood stream during a sharp turn. An example will illustrate its tremendous power. Two years ago, Major Segrave in his 1,000-horsepower streamlined racing car streaked across the Florida sands at 231 miles an hour. Afterwards, a physicist figured out that during that record-making run each tire was writhing in the grip of centrifugal force equal to a four-ton outward pull.

IT IS such forces, infinitely multiplied, that high-speed planes of the future, and the people that ride in them, will have to meet in making turns. A wide turn at high speed produces as much centrifugal force as a sharp one at a lower pace. Even slight variation in direction at speeds of 5,000 miles an hour would menace the vulnerable spots of the human body, Dr. Cooper said.

"Exactly what are these vulnerable spots?" I asked him.

"When a turn is made too fast, the first effects are felt by the brain and the heart. This is what takes place: The blood is driven downward. The brain is deprived of nourishment and momentarily ceases to function. Unconsciousness results.

"The heart, in the meantime, is straining to force the life stream back to the brain. The blood is congested in the lower part of the body. In a modern plane, all this is over in a split second. But no one can predict the exact effect of making turns at the tremendous speeds now forecast for the future."

Tests that the Medical Division of the Bureau of Aeronautics has carried out indicate, Dr. Cooper told me, that pilots are able to increase their ability to withstand changes that bother them at first, just as a man can learn to hold his breath for long periods by constant practice. They develop "tolerances" for quick changes of altitude and alterations in position and speed so that the disagreeable effects upon their bodies become less noticeable. How far this process can be followed has not been determined. It indicates, at least, that the human system tends to adapt itself to the new conditions it finds in the air.

HOWEVER, it is relatively certain that sharp turns at tremendous speeds will have an effect upon the fluid life stream which nothing can overcome. It is at the turns that Nature will call a halt.

"There is an old saying among flying instructors," Dr. Cooper said, "to the effect that flying is easy; it is landing that is hard. Similarly, as far as the human system is concerned, high speeds won't hurt it. It is turning that will be dangerous."

Thus the answer to the often-asked question: "Will men or machines determine the ultimate speed limit in the air?" seems to be: In straight flying, the limit will be set by the machines. The human system can stand any speed that a craft can reach. But on the turns, it is a different story. Here the ability of the men who ride the planes to withstand the effect of centrifugal force will be the limiting factor in determining the answer.

On the skyways, Nature apparently has posted no speed limit. But on the turns she has placed a warning.

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City.....*State*.....

CALLS SUN HUGE ELECTRIC LIGHT

(Continued from page 29)

the changing of matter into energy, a process which Dr. Robert A. Millikan and others declare is continually taking place in the universe. The sun is known to be consuming itself, without leaving any ash or products of combustion, at the amazing rate of four million tons every second, and it is probable that this self-consumption has been going on for millions of years.

This matter disappears out of the universe, and, according to Dr. Gunn's hypothesis, becomes energy in the form of heat and light through the medium of electric current.

THIS theory and the amazing results deducible from it have stimulated American astronomers to renewed effort to solve solar mysteries. Last fall a ninety-three-and-one-half-second eclipse which they observed on "Tin Can Island," a tiny, ring-shaped bit of coral in the South Pacific, gave them a chance to study the sun while it was in process of staging a titanic eruption.

During this phenomenon they saw shooting tongues of incandescent gas streaming a hundred thousand miles beyond its surface, the farthest ever recorded, and, at one point, a glowing red dome, like a gigantic strawberry, thrust itself into space. No one knows the cause of this unusual solar activity or its possible significance.

For two months, the members of an expedition, under the leadership of Commander C. H. J. Keppler, U. S. N., prepared their instruments for the split-second observations on the day of the eclipse. "Tin Can Island," known as Niuafou on maps, derives its nickname from the fact that it is so inaccessible food and supplies are delivered to the inhabitants by throwing them overboard in tin cans and allowing them to be washed ashore. From this island it was believed the best view of the eclipse could be obtained.

In spite of the difficulties of landing their equipment, the party erected, besides the regular instruments, a giant, twin-lensed, 2,500-pound "Einstein camera" mounted on pillars of concrete. This novel steel instrument was used to check up on the theory of Professor Albert Einstein, famous German physicist, that the sun bends rays of light reaching the earth from stars seen near its edge.

THE photographs obtained with the "Einstein camera," the spectroscopes, and the other photographic equipment are being closely examined. Most of the final results of the expedition will not be known before two or three years of study. The spectroscope photographs, made by Prof. Samuel A. Mitchell, of the University of Virginia, are expected to occupy his attention for the next fifteen years!

In spite of centuries of observation, most of the sun's secrets are hid. Only recently we learned that it does not, as formerly supposed, burn year in and year out with the same intensity, but fluctuates in temperature. Only within the last few years have we discovered the baffling, paradoxical fact that when the sun is hottest, the earth is coldest. Only within the last few decades has the mysterious importance of sun spots become apparent. Only within the last century has the spectroscope begun to tell us what the sun is made of.

It is to the spectroscope that astronomy owes most of its intimate knowledge about the sun. Just as the eye might glimpse alternately a pool of cream and a lump of butter swirling in a churn, it picks out first one then another element in the gyrating mass of white-hot gas that forms the solar atmosphere. By analyzing the light that reaches the earth, it identifies substances in the sun.

By use of the spectroscope in 1868, a new important chemical element was discovered in the sun seventeen years before it was found on earth. Sir Norman Lockyer, the British astronomer, who was the discoverer, named it "helium." In 1895 the Scottish chemist, Sir William Ramsay, isolated helium in his laboratory. Today, this valuable gas lifts the *Los Angeles* and other dirigibles and has found an important place in industry.

Of all the mysteries of the sun, none are more bewildering than the sun spots or "atomic cyclones" which periodically sweep its molten surface. These dark blotches on the face of the sun appear and disappear with the regularity of clockwork. They reach their maximum once every eleven years, the last period of greatest sun spot activity being in 1926. At present we are nearing the period of minimum sun spots.

THE exact nature of these dark blotches are still obscure. Recent researches show that they are "cold places" on the sun. Spectroscopic study of the light emitted by them proves that their material is some 2,000 degrees F. cooler than that of the surrounding body of the sun. As an explanation for this, Dr. Donald H. Menzel, of the Lick Observatory in California, suggests that the cyclonic whirl of the atoms at the spot acts as a titanic centrifugal pump sucking the gases upward from the hot interior and cooling them by expansion.

However, these "solar refrigerators" are hotter than anything we know on earth, being in the neighborhood of 5,000 degrees F. The center of the sun, according to Prof. A. S. Eddington, famous English astronomer, must at times run a temperature of not less than 40,000,000 degrees. When sun spots are most frequent, the brightness and heat of the sun increases. But, curiously enough, it has been discovered that during this period, when the sun is hottest, the average temperature of the earth drops about two degrees. It is believed that during these periods the haziness and cloudiness of the earth's atmosphere is increased, thus forming a screen that keeps out some of the incoming heat rays.

In other ways, these "tornadoes on the sun" affect us more closely. Science has shown a close relationship exists between the waxing and waning of these spots and our crops and weather, our electric communications, and the number of "health rays" that reach us from the sun.

AT THE University of Iowa, Dr. C. C. Wylie studied the records of Iowa corn crops for fifty-five years, during which the sun had gone through eleven cycles of sun spots. He found that as the sun spots increased, the yield of corn decreased. The lower temperatures at the time of maximum sun spots is believed to play a leading part in producing this result.

The director of the Observatory of Bourges, France, L'Abbe Moreux, has massed evidence over a period of years that indicates a close relationship between sun spots and the amount of rainfall, and Dr. S. Hanzlik, of the Meteorological Institute at Prague, Czecho-Slovakia, has found that the atmospheric pressure in the monsoon regions of the Orient varies with the number of spots on the sun. In Afghanistan, East Turkestan, and India the air pressure and the sun spots increase together, he reports.

Another interesting discovery of how these spots affect us was made in California. Records of the mean level of the sea in San Francisco harbor *(Continued on page 137)*

CALLS OUR SUN HUGE ELECTRIC LIGHT

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showed that its maximum height and greatest drop occur in regular cycles of about eleven years, corresponding to the increase and decrease of spots on the sun.

Lloyd's, famous marine insurance company of London, is reported to have taken into consideration the effect of sun spots on the sea in granting maritime insurance. It has been found that disasters at sea are eighteen percent more numerous during the two years when the sun spots are most frequent than during the two years when they are least in evidence.

Flaring, brilliant northern lights, and invisible "magnetic storms" that disrupt telephone and telegraph communication, are other mysterious phenomena of the maximum sun spot period.

IN 1926, a giant sun spot, into which half a dozen planets the size of the earth could have been dropped, made its appearance. This spot was the direct cause of the most intense magnetic disturbance in the United States experienced in many years. On January 26, 1926, for more than an hour, near noon, telegraphic communication all over the United States was almost completely paralyzed and transatlantic wireless messages were sent with difficulty.

It is possible that the secret of these magnetic storms lies in the fact that the whirling vortexes of the sun spots bombard the earth with electrons. It has been noted that the greatest magnetic disturbances occur when the sun spot faces the earth directly, just as the most light reaches an object from a revolving beacon when the beacon is turned so it is aimed directly at it.

The discoveries of science about sun spots have just begun. For every puzzle solved, hundreds still remain. And these are but a small part of the perlexing problems offered by the sun. But behind all the many riddles in connection with it there is the supermystery of how the sun functions, what keeps it going, and the nature of its unending storehouse of power. Does Dr. Gunn's theory suggest a possible solution of this hitherto baffling mystery?

MILLION-YEAR-OLD COAL CONTAINS LIVE GERMS

CAN seeds or germs live for centuries sealed up in mineral veins? Dr. C. B. Lipman, of the University of California, reports the discovery of live bacteria in lumps of coal millions of years old, adding to the long list of discoveries of "mummy wheat" and other simple forms of life discovered in mineral samples. Whether any of them existed underground when the minerals were formed, however, is doubted by scientists, who point out that it is almost impossible to keep live germs from minerals in which "mummied" ones have been found.

Germs are in and on everything we eat, breathe, and touch. Thus, in spite of all precautions, it is possible that live germs might find thir way into laboratories on mineral samples, and might then be mistaken for organisms millions of years old.

Biologists say there is probably but one way in which suspended animation can be proved. That is by continued breeding of germs believed to be "mummied," and comparing them at all stages of development with other germs taken from minerals before they were disinfected. If the results show a form of life radically different from any that is known to exist at present, it can be stated positively that a case of suspended animation has been found.

WORLD'S BIGGEST AIRSHIP

(Continued from page 25)

thing, they are not driven into place by noisy air hammers. They are too small, being either three thirty-seconds, one eighth, or five thirty-seconds inch in diameter, depending on the load they must carry; and their lengths vary from 3/16 to 1¼ inch. They are pressed into place by hand operated riveting machines that remotely resemble the punches used by railway conductors for mutilating tickets.

The airship builders could not find such riveting devices ready made, so they had to build their own. A shop in one corner of the air dock devotes most of its time to the making of rivet squeezers of numerous sizes and shapes. Thousands of dollars are being expended for these. The squeezers exert pressures up to 6,500 pounds.

THE rivets are of aluminum alloy, and must be annealed in heat-treating furnaces before they can be used. Then they must be pressed into place within an hour, or they may become crystallized and break. Fortunately, if workmen do not use up a batch of heat-treated rivets within the specified time, the treatment can be repeated.

Almost everyone who drops in for a visit at the Akron air dock asks about the girders. These make up the eleven main frames, the thirty-two intermediate or stiffening frames, the longitudinal connecting members, and various other parts of the ship. There are several different types, but all are much alike; and each contains more space than solid material.

This may seem a strange arrangement, but it has been found that the strongest girder is not always one having the most metal. By taking sheet duralumin and punching out three fourths of it in the form of circular holes, engineers are able actually to increase the strength manyfold. Essential to this is the curving of all edges inward.

At the Goodyear-Zeppelin Corporation plant, a mile from the air dock, most of the manufacturing operations for the ship are carried out. Here, sheet duralumin is run through giant presses that form the sheets into strips, properly punched and ribbed. These strips are assembled in boxlike form, and the typical girder is the result. You can lift, with your little finger, a section that will support an average bridge party.

The Navy expects to fly the new airship over salt water most of the time. So it was necessary to render the metal parts corrosion-proof. If you ever have noticed the changes that occur in an aluminum article when it is kept for some time near the seashore, you will realize the necessity for this.

The girders are all treated electrically by the anodic process to render them immune to salt and other corrosive substances. To provide further protection, the girders are sprayed with an aluminum-flake pigmented varnish. At joints, where the metal must be cut, there is further spraying with corrosion-proof varnish.

MANY visitors come with the impression that the gas cells are to be made from fabric lined with goldbeater's skins, which are obtained from certain portions of a steer's intestinal tract. The fact that such skins are costly and difficult to use has led to the adoption of a specially prepared rubberized fabric, developed by the Goodyear-Zeppelin Corporation. The unprocessed fabric looks like a finely-woven cotton handkerchief, and is made from the highest grade of cotton obtainable.

Similar but heavier cloth is employed for the outer fabric covering. But, instead of being coated with rubber to make it gastight, it is given four applications of a special noncombustible lacquer. Two of these coats are clear, and the remaining two contain aluminum pigment to render the envelope heat-reflecting. This gives the airship a skin that is weatherproof, that is as strong as metal of equal thickness and weight, and that will not support combustion.

There has arrived in Akron from Germany a shipment of eight giant Maybach airship engines that will be installed in special compartments of the airship. It may seem peculiar that, while Germany imports American engines for her largest airplanes, Germany, in turn, sends across the Atlantic engines for America's greatest airship. The reason for using German power plants in the *Akron* is that no satisfactory reversible airship engine has been developed in this country. A generation of development work is behind the German Maybach, designed specially for lighter-than-air craft.

ON a testing stand erected at the Zeppelin factory the engines and their propeller-driving mechanism have been put through rigorous tests. Those familiar with the power units have declared that, had the British airship *R-101* been equipped with a propeller arrangement such as that being built into the American Zeppelin, the recent destruction of the ship in France probably would not have happened.

The engines are mounted inside the envelope, in special fireproof rooms contained in main frames of the hull. Running from each engine out through the side is a steel propeller shaft, supported by a streamlined outrigger. The outer end terminates in a ball-like device that contains bevel gears. The propeller, driven through these gears, is at right angles to the shaft. The gear housing is ridged with cooling vanes.

The propeller—this is the important feature—can be rotated through an arc of ninety degrees, so that its axis is either vertical or horizontal. With the engine running in the forward direction, the propeller can be tilted so as to drive the ship vertically downward, horizontally forward, or at any angle between the two. With the engine reversed, the propeller will force the ship astern or upward.

Thus the propellers can be used to move the ship in practically any direction, to a degree independently of the rudders or action of the gas or ballast. Thus an overloaded ship or one whose gas is leaking badly can be safely maneuvered simply by manipulating the propellers.

AKRON is looking forward to entertaining the largest crowd ever assembled within its boundaries, probably some time in May. That is when the new airship is to be taken out of its dock and launched on its maiden voyage. The airport area about the dock has been graded and sown in grass.

One of the surprises awaiting spectators is that the ship will be taken out of the dock and launched without the help of a young army. In fact, five men can launch or dock the air monster.

The key piece will be a walking mooring mast that guides the nose of the ship, and then holds it after it is out on the field. This mast, constructed at the dock, has three tractor tread feet, and is similar to that which the Navy has been using at its air station at Lakehurst, N. J. The ship will be further guided and held down by launching devices, running on tracks that extend through the dock and for nearly one third of a mile beyond either end.

RADIO PROGRAMS NOW RECORDED AT HOME

(Continued from page 83)

of the pick-up head you are using.

Hooking the pick-up to your set is simple if you have an old set fitted with loudspeaker binding posts to which the loudspeaker cord tips are attached. Just connect the pick-up cord tips to the same posts. This will allow the loudspeaker to operate at the same time so you will know when to start and stop the recording.

If you have a modern set fitted with two power tubes in push-pull and a dynamic speaker, take out the two power tubes and wind the bared end of a small piece of wire several turns around the plate prong close to the base. The plate prong enters the right-hand one of the two smaller holes when you are looking down on the socket with the smaller holes farthest from you.

CONNECT these two wires to the pick-up cord tips and be sure that they do not short on the base or on any other metal part when you push the tubes back in place.

To record speech or music some kind of a microphone is necessary. Microphones sell at prices ranging from a few dollars to hundreds of dollars depending on the quality. The best and most expensive grades are, of course, used in the better class broadcasting and recording studios.

If you have no microphone you can use a pair of headphones. Keep the same set-up as for radio program recording and hook one of the headphone cord tips to the grid of the detector tube. The other should be connected to the metal frame or to ground. With battery sets, the prong is the one that enters the left-hand small hole as you look down on the socket with the two small holes away from you. In electric sets, the detector grid prong is the one that is spaced from the other four of the 227 tube.

Better results will be obtained if only one headphone is used, so short-circuit the other phone or disconnect it. A loudspeaker unit of the kind sold for attaching to the tone arm of the phonograph will give somewhat better results and a magnetic cone speaker will be better still. Because of its large area, the cone speaker may cause feed-back howl, in which case it should be placed in another room with the door shut or else the loudspeaker on the set should be muffled by covering it with a blanket.

You will have a lot of fun experimenting with home recording, but don't expect too much in the way of fine tone quality. It cannot be had with such simple apparatus.

OLD CIRCUIT RETURNS

(Continued from page 84)

to understand why these two changes did the trick. The single control makes it impossible to tune the oscillator to the other interference or beat frequency. The single dial control always assures the correct frequency difference in the same direction.

The hashing together of stations that happen to operate on the proper frequency above and below the oscillator frequency has been eliminated by tuning ahead of the detector. An interfering station obviously would have to be exactly twice the intermediate frequency away from the desired station, or 250,000 cycles, and a station so far removed in frequency couldn't get by the sharply tuned detector circuit.

The selectivity of the superheterodyne will be discussed next month in POPULAR SCIENCE MONTHLY *in an article dealing with the selectivity of modern radio receiving circuits.*

NEW DOGS FOR FROZEN NORTH

(Continued from page 41)

me the other day by Mrs. Elizabeth M. Ricker, noted dog breeder and partner of Leonhard Seppala, the famous driver. Mrs. Ricker, who conducts the Seppala Siberian Kennels at Poland Springs, Me., is the only woman ever to participate in a major eastern race, her dogs twice having captured the condition prize at Quebec.

When white men first explored the frozen regions of America, she told me, they found there a tribe called the Husky Indians, whose only means of transportation was a big, strong sled dog resembling the present-day Alaskan husky. Pushing on and penetrating Alaska, they came upon another Indian tribe, the Malamutes. These red men, too, had a special breed of sled dog, which since has been named for them. These were the two original pure-bred northern dogs on this continent.

A THIRD kind of dog the early explorers found among the Indians was a cross of some sort, probably between the malamute and the wolf. Somewhat to the confusion of that portion of the public interested in dog breeding, it is this dog that has become known as the Alaskan husky.

With the increase in the numbers of pioneers in Alaska, experimentation in breeding began. The result was a conglomeration of mongrels possessing neither good looks nor intelligence. But those produced by breeding to fleet-footed, lightly built animals from the south, such as Russian wolfhounds, greyhounds, Irish wolfhounds, and whippets, really turned out to be extremely speedy. Those sired by Great Danes, Mastiffs, Newfoundlands, and St. Bernards proved remarkable for their strength and endurance.

About the year 1908, dog racing as a sport was established in Alaska and it was then that a more intelligent interest in dog breeding was aroused for the first time. In those glamorous days, when the All-Alaska Sweepstakes began to be an event exciting the enthusiasm of virtually every dweller of the North country, the dog lovers soon were divided into two camps. One group staunchly supported the swift Alaskans, meaning the native dogs crossed with hounds, setters, pointers, airdales and whatnot; the other preferred the Siberians—small, prick-eared animals with bushy tails curled up over their backs.

THE Siberians were first used in the All-Alaska Sweepstakes of 1910, when John Johnson, a Finn, driving a team of them entered by Colonel Charles Ramsay, of London, England, came in first. The weather had been ideal, and they had broken all records, covering the 408 miles between Nome and Candle Creek and back in little more than seventy-four hours. Closely following was Charles Fox-Maule Ramsay, nephew of Colonel Ramsay and younger brother of the Earl of Dalhousie, driving his own team of Siberians.

It seemed that the day of the Siberians had come. With a view of producing a dog that might successfully compete with them, Alaskan dog lovers decided to breed all foreign strains out of the so-called "Alaskan hound;" in other words, to restore the original northern breeds. This they did by breeding the Alaskan back to the Yukon wolf. The result, an animal in which the wild strain predominates, still is in the process of evolution.

In that manner was evolved the Eskimo, a term covering any type of real northern dog bred on this continent. The Eskimo so far is the only Arctic breed recognized by the American Kennel Club, the official body of registration in the United States. Its rules require an Eskimo to weigh at least forty pounds, although the better type is closer to sixty-five pounds, and his ancestry must be clear of offshoots, meaning that he must be the product of three or four generations of straight breeding.

He is a sturdy, well-boned animal, with excellent body qualities and strong legs. His resemblance to the wolf is accentuated by his long muzzle and his erect, triangular ears. His eyes are set obliquely, like those of the wolf, while his jaw and teeth are formidable.

The Siberian is an entirely separate breed. Having originated in a community where it was almost impossible to import outside strains, experts consider him the type closest to the true prehistoric dog. According to Mrs. Ricker, the Siberian is the fastest, most intelligent pure-bred northern dog with the greatest amount of endurance, and also the gentlest.

BUT this, after all, is only one expert's opinion. In the All-Alaska Sweepstakes of 1911 and 1912, the Siberians lost, and through terrific blizzards and over miserable trails, the Allan and Darling teams of Alaskans, driven by the famous "Scotty" Allan, were the winners. Again, in 1913, Fay Dalzene was first with the Bowen-Dalzene dogs, which also were Alaskan hounds.

On the other hand, the 1915, 1916, and 1917 races all were won by Seppala, driving Siberian teams each time. Seppala was the only driver ever to lift the $10,000 purse three times in succession. It was this feat, together with America's entry into the World War, that caused the great Alaskan classic to be discontinued.

At Wonalancet, N. H., Arthur T. Walden, who conducts the Chinook Kennels there, is seeking to establish an ideal type along the lines of his Chinook, the dog that led a team to an eastern international triumph in 1922 at Berlin, N. H. Chinook weighed 105 pounds and had strength, stamina, and speed. His mother was a North Greenland Eskimo from one of the teams that went with Admiral Peary on his journey to the North Pole.

Walden, who spent many years in the Arctic and who had charge of Admiral Byrd's dog teams in the Antarctic, where Chinook died, has mated Chinook to shepherds with success. One litter in particular produced five splendid males that have all the characteristics of the sire, including his sagacity. It was this litter, with Chinook at the head, that went to the summit of Mount Washington in the winter of 1926.

HI MASON, of Tanworth, N. H., has obtained fine results from the mating of a collie and a husky. Probably the best kennel of pure-bred Eskimo dogs in the country is that of Edward P. Clark, at West Milan, N. H. His interest in dog driving and breeding was developed when he was a fur buyer in Labrador.

Mrs. Ricker's kennel, at Poland Springs, Me., is recognized as the finest for Siberians. Only recently, she imported eight pure-bred Siberians from the Kolyma River region in northern Siberia. These dogs constituted the team that brought back the bodies of Carl Ben Eielson and E. Borland, his co-pilot, who came to grief while flying over that country.

In a general way, today's derbies are governed by the same rules that were in force at the All-Alaska Sweepstakes. The traditions of that famous classic survive, and stories in connection with the great races are swapped where- *(Continued on page 141)*

NEW DOGS FOR THE FROZEN NORTH

(Continued from page 140)

ever dog men of the North get together.

The drivers took the greatest care of their animals, and at every roadhouse or relay camp where they stopped for food and sleep it was "dog first," no driver thinking of himself until his team was fed, rubbed, and bedded. Little moccasins of Canton flannel were carried to be used on hard trails, and veils of black and green mosquito netting were placed over the dogs' eyes if the glare of sun on snow was too dazzling.

On short distances some of the dogs are remarkably fast, traveling at the rate of fifteen or sixteen miles an hour. Irish, one of the Allan and Darling team, an Irish setter with some husky blood, could go a mile in three minutes. Spot, a cross-bred pointer and husky, after leading a team for thirty miles, covered four miles in thirteen minutes and twenty-five seconds.

THE record for strength, endurance and speed combined was made by Seppala's Siberians in the famous serum dash of 1925, when it was necessary to send antitoxin serum from Nenana to Nome, a distance of 665 miles. By relays of teams, led by the wonder dogs Togo and Balto, this distance was covered during blizzards and at sixty degrees below zero in five and a half days, or an average of about 125 miles a day. A statue of Balto has been erected in Central Park, New York City, while the body of Togo, who was pensioned and died of old age at Mrs. Ricker's kennels, is in the Peabody Museum of Yale University.

The lead dog is selected regardless of age or sex. The leader usually is left to pick the track through unbroken snow, and will take a circuitous route, dodging anything in the way of mounds or hummocks that possibly might upset the sled. On a broken path, it will follow the previous tracks without a desire to deviate.

The stories told of the marvelous intelligence of certain leaders are almost beyond belief. A leader has certain privileges, such as getting into the sled when the driver is not at the handlebars and reposing in comfort on the furs while the rest of the dogs lie in the snow. Occasionally bitter jealousy is felt by the others toward their leader, and the utmost precaution is necessary to guard him from their attacks.

SOME leaders, however, through great strength and superior intelligence, become more or less exempt from this ill-feeling, and their leadership is freely tolerated. Among these, Dubby, a magnificent specimen of the McKenzie River husky, brought down by "Scotty" Allan from the Klondike region, was one of the most famous. Dubby lived to be twelve years old, but was pensioned in his ninth year, still in perfect condition and able to enjoy the rewards of his service.

He had to his credit a record of over 30,000 miles in harness and the stories told of his sagacity are legion. Often he was driven loose, running ahead of the team instead of being hooked up with them, and he was so efficient as a manager that the loss of his pulling power was of small moment compared to his ability to find and keep the trail, and his capacity for doing many other clever and helpful things.

In the records of America's frozen North, epic stories have been written by the sturdy four-footed trail blazers. Without them, it would have taken fifty years longer to open up the great white empire of Alaska. Now, with science assisting sport to perpetuate the old breeds and originate new ones, they are writing new sagas in those sections of the United States where winter still is winter.

A definite program for getting ahead financially will be found on page four of this issue.

AIRSHIPS WERE DEATH TRAPS

(Continued from page 61)

It slithered over roofs and bounded from yard to yard. One man grabbed the rope, was dragged over a fence, let go. In a momentary lull in the storm, a dozen people on a street corner caught the rope. The ship was jerked to a standstill.

People were racing toward the spot from all directions. I could see women and children leaping over fences and running across back yards. Motormen as well as passengers left street cars and joined the throng. Three hundred excited people tried to get hold of the rope. Buffeted about by the gusts, the bag was nearly impaled on a church steeple.

AT last the framework struck the roof of a house and tobogganed down into a vacant lot next door. I had ridden the runaway airship for an hour and a quarter and was soaked to the skin. Such experiences taught me much about the air, practical lessons in meteorology, which later stood me in good stead when I began piloting airplanes. A "course of airships" would still be good training for pilots.

Five hours and twenty minutes was my longest flight in a dirigible. I set that American Dirigible Endurance Record on August 30, 1906, at Louisville. The day was a scorcher. The sun so expanded the gas at one time that I rose to more than 5,000 feet. Miles and miles of green fields stretched below me on either side of the blue Ohio. It formed one of the prettiest pictures I have ever seen.

I crossed the river, circled around New Albany, Ind., and flew up and down the Ohio for hours. Then, with my twelve gallons of gasoline gone, I came down in Glenwood Park, New Albany. The whole town turned out and half of Louisville crossed the river. The crowd was so great that the police could not handle it. Boys swarmed all over the place. A dozen of them began chinning themselves on the framework. With a crack, the spars gave way. We deflated the bag and carried the machine back to Louisville on a boat.

IT used to break my heart to let out a bag of gas. From thirty-six to forty-eight hours were required to generate enough hydrogen for the dirigible and the cost was in the neighborhood of $600. Into great wooden tanks we would pour tons of iron filings, sulphuric acid and water. The acid eating away the filings produced the hydrogen which was carried by cloth pipes to the gas bag. Great care had to be taken to prevent air from being sucked in with the gas. A small percentage of air in a gas bag would kill the buoyancy.

The big generating vats were carried from place to place on a special car that transported airship and crew. On the outside of this car, in electric lights, was the sign: "Horace B. Wild, the King of the Air." At all hours of the night, we used to hear the moan of the generator, supplying the current, as "Mose", the colored helper, plugged in the sign while we ran through towns and villages. When we arrived at our destination, we would unload a one-lung Apperson automobile and I would appear in a high silk hat and be respectfully addressed as "Professor."

Nineteen hundred and seven was "Airship Year" in America. Beachey, Baldwin, Knabenshue, Dixon, Goodale, Dallas, Mars, and I were racing our motored gas bags and giving exhibitions before immense crowds at the larger cities. Nobody in America had yet flown an airplane in a public exhibition. It was nearly a year later that the first public flight was made in the Aerial Experiment Association's biplane, the *Red Wing*, over the ice of Lake Keuka, near Hammondsport, N. Y.

In the fall of 1907, St. Louis held a "Balloon Week." The whole country went "air-minded." Cartoonists showed old gentlemen standing in wicker waste baskets, pretending they were in balloon baskets, and saying: "I'm a balloonatic now!" The papers reported that President Roosevelt's first question on arriving at the White House from a hunting trip was: "Who won the balloon race?" While St. Louis citizens discussed the dangers of aerial travel, a man fell down an elevator shaft as he watched a dirigible, a woman walked in front of a street car, and fifty boys dropped a dozen feet when a shed roof, on which they were packed, caved in.

THE most spectacular flight of the meet was made by a slender thirteen-year-old boy who came to the contest wearing knee pants. He was Cromwell Dixon, of Columbus, Ohio. Dixon was a fine-featured boy who spent his spare time playing a Stradivarius violin that had been in his family for 200 years. When he was eleven, he started building his dirigible. His mother sewed the silk bag on her sewing machine and when it was finished, Cromwell slung a bicycle frame, minus the wheels, below. When he pedaled the bicycle, a three-bladed propeller of tin pushed him through the air. By the time he was thirteen, he had made 300 ascensions in his "sky-cycle."

Taking off at Forest Park, in St. Louis, he circled over the downtown district of the city. Above a busy street corner, the chain slipped off the sprocket. He calmly leaned down, adjusted it, and pedaled off in the direction of a ball park where the firemen and policemen were playing a championship series. Here he called down for someone to knock a home run.

After watching the game for several minutes he headed for the Mississippi River, crossed the mile-wide stream, and landed at Venice, Illinois, ten miles away. When his mother, who had followed his flight in an automobile, arrived, he was packing his deflated airship in a delivery wagon for the trip back to Forest Park.

A few years later, Cromwell joined the Curtiss flyers. He piloted the first airplane over the Rocky Mountains near Helena, Montana. Only two days later, he side-slipped to his death in the treacherous air currents boiling around the high plateau. I had a narrow escape in a similar side-slip crash in an old Curtiss pusher biplane at Champaign, Ill., in the fall of 1910.

THE last time I saw Glenn Curtiss, in the spring of 1930, he spoke of the astonishing ease with which modern ships are controlled as compared to those early biplanes. As one of his guests, I flew down the Hudson from Albany to New York in a giant Curtiss Condor in celebration of the twentieth anniversary of his famous flight over that route, when he won the $10,000 *World* prize in 1910.

The big event of the St. Louis meet was the airship race on the last day. A hundred thousand people jammed the park at this climax of the $40,000 meet. The veteran, "Uncle Tom" Baldwin, was there with a new and more powerful motor in his *California Arrow*. Lincoln Beachey had brought his fast ship. Jack Dallas was riding a machine constructed by a Toledo, Ohio, bandmaster, and I was at the starting line with *The Comet*.

Baldwin took *(Continued on page 144)*

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WHEN AIRSHIPS WERE DEATH TRAPS

(Continued from page 142)

off first, battling into a fifteen-mile wind. He reached the Blair Monument, three quarters of a mile away, turned, and came back over the starting line in exactly six minutes. Then the motor of *The Comet* began to rattle. I shouted "Let go!" and was off. Just as I rose into the air, there was a lull in the wind. Leaning low over the framework, I was clipping seconds from "Uncle Tom's" time at every hundred yards. Then, without warning, the engine stopped as though struck by lightning. The magneto wire had vibrated loose and dropped to the ground. Helpless, I drifted off the course and landed in a field a mile away. Dallas also had motor trouble, and Beachey, skimming low over the grand stands and rounding the monument below the roof of the Monticello Hotel, captured first prize in four minutes and forty seconds.

THE queerest race I ever ran with a dirigible took place at Sioux City, Iowa, in September, 1907, with Dan Patch, the famous race horse, as my opponent. Half the farmers in Iowa came to see the race and cheer for Dan Patch. For five days, we put on a daily race and every time the horse left my *Eagle No. 4* at the post. Before I could push that gas bag a quarter of the way around the mile track, Dan Patch was streaking across the finish line. And I cut the corners, too.

In racing "rubber cows," one of the chief dangers was the likelihood of blowing out the tail of the airship. When the cigar-shaped envelope was driven through the air it met great outside resistance at the nose, while at the tail the outside pressure was reduced. As a result, internal pressure concentrated at the rear.

A second danger of pushing a gas bag rapidly through the air was that if the silk was not taut, the nose might belly in and be cut by the whirling propeller. To keep the envelope taut, I had a small air balloon inside the main envelope which could be filled by means of a pump attached to the motor. As gas leaked out of the envelope, or chill condensed the hydrogen, I blew up the air balloon to increase internal pressure and keep the envelope taut. Once, even this was not sufficient to avoid catastrophe.

I was flying *The Comet* at a fair at Omaha, Nebr., in October, 1907. Several miles from the city, it got tangled with some wires. It was late in the evening before it was in shape to fly back to the fair grounds. The chill of twilight had condensed the gas. I had to leave my coat, vest, and even my gold watch and chain behind before I could get off the ground. I had the interior air balloon completely full, but even then the gas bag, as I started off, resembled a dejected tomato worm.

ABOVE the heart of the city, I tried to speed up. The flabby nose of the gas bag bellied down. A blade of the white propeller disappeared for an instant gashing a four-foot hole in the envelope. The gas rushed out with a hiss and down we went tail first. I landed right in a hospital yard. All they had to do was to carry me in.

That was the way we flew twenty-three years ago. Haphazard hops in under-powered "rubber cows" that were ready to explode like firecrackers or burst like paper bags—that was aeronautics in 1907. These lighter-than-air tumbleweeds of the sky, bowled along by the slightest wind, breaking down on every flight, probably had little practical value. But they helped make the world air-minded and prepared the way for the everyday sky travel now a reality.

DESIGN YOUR HOUSE TO FIT ITS SITE

(Continued from page 79)

lights in this room, the entire interior illumination depending on movable floor and table lamps.

The kitchen, or "laboratory," is most compact, and was so placed that a pleasant view of the garden is obtained. The legs of the stove were removed and a cupboard for large cooking utensils placed beneath. The pot closet was built next to the stove, in which the equipment is hung against the wall instead of being piled on top of each other, as in many kitchens.

Special attention was given to such small but comfort-making details as toe space beneath the counters, placing of the first shelf in the cupboard above the counter so low that the second shelf is reached easily, and a special shelf for flower bowl and clock. The sink is of acid-proof material set in small mosaic tile. Small shelves are provided in the cooling closet for spice boxes and similar containers, which are usually lost on a large shelf.

FOUNDATIONS, as well as all retaining walls, were reënforced with steel, the former with two ⅝-inch bars placed both at top and bottom. To prevent inroads by subterranean termites, all woodwork in the basement is kept at least six inches above grade, while numerous screen vents insure good ventilation throughout all the area beneath the house. Ground and woodwork under the building were treated with a patented preparation as a further preventive of insect attacks. The house is insured by a reliable antitermite company, and is thoroughly inspected twice a year.

The exterior of this house is stucco, applied over heavy sixteen-gage, one-inch mesh wire netting, outset from the sheathing by metal cleats. The roof is of split shakes, left to weather a natural warm brown.

After the house was built, it was decided to establish an office in the rear of the garden. The site selected is some five feet higher than the garden level. It was walled off and on it, in the manner shown by the accompanying sketch of the grounds, was erected a two-story, three-room office, of design that harmonizes with the house and with the general contour of the lot. Downstairs, this structure contains two rooms—an outer office for my secretary, where callers may wait, and an inner private office.

One of the accompanying photographs shows the interior of the private office and suggests its treatment. The woodwork is painted white, with touches of gold leaf on some of the cornice molds and around the fireplace. There is a wood dado on two sides of the room. Above this, Madagascar grass cloth of cream color has been applied on wood backing. This facilitates the tacking of drawings on the wall, and also gives suitable background for some old William Blean maps, dated 1638, which are framed with glass on two sides so that the inscriptions on the backs of the prints may be read.

ON ONE side of this room a battery of casement windows, above low cupboards, overlooks a small, private *patio*. This *patio* is on two levels, due to inequalities of the ground, and contains a fountain, three or four trees, and about 100 potted plants. For furniture, there is a copy of an old bench at Mission San Juan Capistrano, a table, and a few stools.

In the second story of this building there is a large drafting room with accommodations for eight men at one time. Such a private office attached to a city home site is often convenient for a physician, attorney, architect or other professional man.

UNCLE SAM EXPOSES FAKE CURES

(Continued from page 27)

reporting the case immediately to the Chief Post Office Inspector, Washington, D. C.

Some companies have mulcted the public out of more than a million and a half dollars before their owners were brought to justice, largely because those on the "sucker list" were ashamed to admit that they had been "taken in." One of the quickest captures made stopped a promoter from selling a fake curative when the total sum he had received amounted to only two dollars and fifty cents.

SOME of the devices are relatively inexpensive—as, for example, a "Vacuum Fat Remover," which consisted of a rubber cup to be pressed down over the fatty tissue to "suck off the superfluous weight by means of a vacuum." It sold for about a dollar. But that was a dollar too much, as the outfit was worthless. However, the higher the price, the better the fake device seems to sell.

One man was so anxious to get an apparatus guaranteed to restore his youth in ten days that he couldn't wait to send the price, $1,000, by mail. He telegraphed it. And he has been writing almost daily letters to Post Office officials ever since trying to get his money back.

It should be noted that the Post Office Department can make no guarantee to get money back that has been sent to crooked promoters. All it can do in most cases is to stop the criminal from fleecing others.

One of the devices that sold at a fancy price was an "Infra-Red Ray Hair Restoring Skullcap." It was a small black bonnet with a tiny electric heating coil, covered with asbestos, in the top. When the electrical connection was plugged in, the coil warmed the top of the wearer's head. According to the advertisements, the cap gave off penetrating infra-red rays that entered the scalp, stimulated the roots of the hair, and made thick and beautiful locks spring out of heads formerly as bare as a billiard ball.

In fact, these rays were said to be so penetrating that they reached down to the wearer's jaws and would stop a toothache as well as grow hair! Tests at the laboratory showed that a hot water bottle would give off just as many "infra-red rays" as the magic bonnet.

NOT all of the work of this fraud-hunting laboratory concerns mechanical devices. Making a careful chemical analysis of powders, pills, and liquids, for which wonder-working powers are claimed, is another important phase of the work.

A few weeks ago, a test was made of some powder that was being advertised as able to cure a whole catalogue of human ills. Three pinches of the powder were to be placed in the shoes of the user every morning. The result would be that fevers, inflammations, infections, and microbes would be "drawn off through the feet" during the day. A chemical analysis of the compound showed that it contained nothing but common baking soda and sulphur.

Another chemical analysis revealed that a "sure cure for pyorrhea" was simply sheep dip, such as is used on farms to kill ticks on the animals, done up in a flossy package.

Not many years ago, a promoter actually sold eye drops that were purported to cure bowlegs and flat feet! The afflicted person was to put a drop of the liquid in his eye twice a day and watch results—if he could notice any.

The eyes are a favorite point of attack for the crook who is mulcting the public with his fake curatives. When the chemists of the Collaborative Investigations laboratory examined, not long ago, one compound that was guaranteed to cure cross-eyes, they found that its formula read like a cake recipe. It was concocted of strained honey, egg yolks, distilled water, and unsalted butter. The purchaser was supposed to put one "or more" drops of this mess in his eyes three times a day.

There are three different branches to the attack made by the Government on the sellers of such worthless nostrums. The Post Office Department prevents the convicted crook from using the mails, the Food and Drug Bureau has control over the labels placed on bottles and boxes, and the Federal Trade Commission sees that the advertising contains no fraudulent claims. But even so the criminals sometimes rob thousands before they are caught.

ONE of their best baits is the testimonial given by a "benefited user." How unreliable such testimonials are is revealed by the fact that the Post Office investigators discovered in one case that seventy-five percent of the people who testified that a tuberculosis cure had restored them to health had died of tuberculosis. And the promoter, who later died of the same disease, kept on using the testimonials for ten years after the people who gave them were dead!

One of the most recent of these "guaranteed cures" for tuberculosis, by means of which a heartless promoter fleeced thousands of unfortunate invalids, came in the shape of little cones of incense. They were to be burned over an alcohol lamp in the bedroom before retiring for the night. The windows were to be left closed so the "curative" fumes would be breathed during sleep. A chemical examination of the cones showed they were made of charcoal, a little sulphur, and a slight amount of eucalyptus oil to give the smoke a pleasing smell.

However, sick people are not the only ones fleeced by fraudulent claims. A year or so ago, thousands of city dwellers bought a miniature churn that would turn one pound of butter into two. The laboratory test showed that all it did was to produce an adulterated and comparatively worthless product in place of the good butter.

While city people were buying the fake churn, farmers were purchasing a miraculous "sex determiner" which would tell them whether an egg would hatch into a hen or a rooster. This device consisted of a red peg, either of wood or iron, which was suspended from a metal bar by a silk thread. When an egg was placed underneath, the peg was supposed to swing to one side or the other. If it swung to the right, that meant a rooster; if it swung to the left, it indicated a pullet.

WHEN the device was held over things that had no sex at all, such as rubber dogs and celluloid fish, in the laboratory, it acted just the same as it did when held over an egg. The result depended largely on the steadiness of the nerves of the holder and the air currents in the room, and not on any magical powers of the red peg.

But what probably caps the climax in the way of impossible claims was one investigated by the laboratory on the complaint of poultry growers who had bought a "red-hot pepper compound, guaranteed to rid chickens of lice." The promoter declared that if the powder was mixed with the chicken feed it would cause the hens to "sweat off all the lice and mites." That was one time when the laboratory didn't have to make any chemical analysis, because the workers knew what some of the poultrymen didn't know—that chickens don't have sweat glands!

HEAT YOUR CAR BUT DON'T BURN IT

(Continued from page 86)

and circulates the air through the cast-iron radiator by a small electric fan. This one," he went on as he opened the second package, "is the same idea, using hot water. It's got a fan, too. The only difference is that the exhaust gas heater gets hot a lot quicker. I find that doctors and others who have to make a lot of short trips with long waits like the exhaust type pretty well because they get heat quick. Salesmen that make long trips are much more likely to pick the hot water job."

"But I don't see how you can get enough heat from the hot water system," Green objected. "The motor runs so cold there isn't any real heat in the water."

"IF IT does," Gus retorted, "that's your fault for not covering up part of the radiator. Of course the kind of anti-freeze you use makes a difference. You can't run the motor at summer temperature if you use alcohol, so the exhaust gas heater would have the edge on the water job if you keep the motor cold to save alcohol. If you use glycerin or green ethylene glycol, you keep the motor as near the boiling point as you please."

"How about ventilation with those two?" Green asked.

"Leave one of the windows open," Gus explained. "The fan keeps the air circulating so the draft isn't so bad. This one," he said, opening the third package, "takes care of the ventilation too. This funnel-shaped opening is fastened right back of the engine fan and the fan forces a stream of fresh cold air through the heater and then through the opening in this fixture which fastens over a hole cut in the dash.

"Of course the cold air is heated so it's good and warm by the time it comes out the hole in the dash. This particular job uses the hot water for heat."

"Seems to me," Green broke in, "I've seen the same thing worked out as a cover for the exhaust manifold. Why isn't that simpler?"

"It is if you don't mind the hot engine smell," Gus explained. "Then, too, any leak in an exhaust gasket will fill the car with gas."

"Why don't somebody invent an electric heater that you could hook up to the battery like the rest of the electrical equipment of the car?" Green suggested.

"Would the heat from a dinky little electric toaster be enough to warm your car?" Gus countered. "It takes two hundred and fifty watts of current to run a toaster and your generator produces only eighty watts, and most of that has to be used to charge the storage battery. Also, what would be the use of burning more gasoline to drive a bigger generator just so you could operate an electric heater when you have a lot of heat going to waste already?"

"I'm wrong again," Green laughed. "Well, I guess you'd better put in a hot water heater. After what just happened, my wife would feel safer."

THERE was a frigid snap in the air next morning as Green and his wife set out. They passed the Model Garage just as Gus was opening up for the day.

"I wanted to thank you, Mr. Wilson," chirped up Mrs. Green as they stopped, "for selling my husband that ducky little fixture with the door that lets the heat in from the engine compartment. That's much better than that awful thing he installed."

Green slyly winked, Gus smilingly acknowledged her thanks, and the car drove on.

MYSTERIES OF OYSTER'S LIFE

(Continued from page 58)

At first it was thought they were sick. Nearly a thousand learned papers were written on the mystery of the green oysters.

Two years ago, Dr. Galtsoff proved conclusively by a series of observations and tests that "green" oysters are as well as any other kind. It is believed that the industrial wastes dumped into the Sound from factories along the Connecticut shore are responsible for an increase in copper in the water. But it is still a puzzle how so much of the metal is collected when the concentration in the water is necessarily low. From a single bushel of "green" oysters, as much as two pennyweights of pure copper can be extracted.

ANOTHER mystery that Dr. Galtsoff was called upon to solve was the reason for the high mortality in the beds of a valuable little oyster off the coast of the state of Washington. He found that chemicals being poured into the Pacific from the paper pulp mills of the region were killing the bivalves. As little as five parts chemical to a thousand parts water caused the oysters to stop feeding.

Just how sensitive oysters are to the presence of chemicals in water has been demonstrated by a series of experiments made by Dr. A. E. Hopkins, of the Bureau of Fisheries. He found that they are especially susceptible to potassium salts and react quickly to quinine. They can detect quinine in a solution four times weaker than can be noticed when applied to a human tongue.

The body of an oyster is like a living pump. When it is feeding, a stream of water from which the invisible organisms are strained is kept flowing through the gills. Around every hole and tube of the gills there are tiny whiplike organs that beat at right angles to the surface as a whole and in so doing force the water into the openings. Other whiplike organs cover the surface of the gills. They beat parallel to the surface and their function is to keep the gills clean.

In 1928, Dr. Galtsoff devised a simple method of determining how much water these little whips drive through the gills of an adult oyster. He forced the shell of the oyster apart, without injuring the hinge, and inserted a small glass rod to hold it open. Then he introduced a rubber tube into the opening of the gill cavity and packed it fast with cotton. When the specimen was placed in a tray of sea water and began feeding, he measured the velocity of the current passing through the tube and in this way computed the rate of flow.

THE temperature, he found, governed the amount of water pumped by the oyster. The maximum flow was reached between the temperatures of seventy-seven and eighty-one degrees Fahrenheit. Then an adult oyster would pump as much as four quarts of water an hour. With a lowering of temperature, the filtering process slows down. The bivalve ceases to feed altogether and goes into hibernation when the water becomes colder than forty-one degrees. In a majority of the tests, the hibernating mollusks would start the current flowing again as soon as the temperature rose to 46.4 degrees.

The reason ascribed for the failure of the oyster to feed at low temperatures is that the tiny whiplike organs cease to function in unison below the forty-one-degree deadline.

On some of the reefs of the South Atlantic and Gulf states, where the shallow water has a uniformly high temperature, the oysters filter large quantities of sea water, yet remain thin and starved. They are known as "coon oysters" and have little commercial value. Dr. Galtsoff investigated. He found the reefs covered with masses of oysters so thick that he estimates that the same water of the shallows was filtered three or four times. In the warm water, the oysters were reproducing more rapidly than the food supply warranted and, like the apples on an overburdened bough, could not get sufficient nourishment to reach full size.

This fall American oysters are reported to be of superior size and taste. The reduced amount of fresh water entering the sea, due to the prolonged drought of the past summer, is given as the cause by oyster growers. It resulted in greater concentration of minerals and salt in the ocean water along the coast where the beds are located, thus speeding up their growth and adding to their flavor.

Because an oyster may retain the germs of water-borne diseases, as well as the microscopic organisms that form its food, great care is exercised to keep the beds unpolluted. The state health departments, under direct supervision of the U. S. Public Health Service, test the water at the feeding grounds and examine specimens of the oysters. Unless a bed had a certificate attesting its sanitary conditions, oysters cannot be sold from it. Besides, frequent bacteriological tests are made upon shipments when they are received in large cities.

THE pearl oyster, found almost exclusively in the tropics, is much larger than the type that is commonly eaten. It often measures a foot or more in diameter and has thick and heavy valves. The only pearl oyster beds in American waters are at Hermes and Pearl Reef in the Pacific, near Hawaii. Dr. Galtsoff recently made a survey of these beds and found fifty large pearls in 150 specimens. Because of the reduced number of pearl oysters there, the Government has closed the beds for three years.

How long each day does an oyster "stay on the job"? How many hours, out of twenty-four, does it "sleep"? Those questions Dr. Galtsoff was able to answer after testing 200 different oysters. Instead of watching night and day and making notes, he accomplished the end in an easier and more nearly accurate manner. He let the oyster write its own record on the graph of a simple laboratory apparatus which he rigged up.

As feeding stops when the shell closes, the exact minute when the oyster ceased its labors could be determined. Dr. Galtsoff held the mollusk upon which he was experimenting in one position by embedding its left shell in a mixture of one part cement and three parts plaster of Paris. A glass rod was attached, by means of the same mixture, to the right, or upper, valve of the oyster. This rod was attached to a time recorder so that every movement of the shell raised or lowered the pen that kept the record on the graph.

THE oysters were kept attached to the apparatus and under sea water for varying periods of from one to eight days. When the 200 records were examined, they revealed that the average oyster remains open and "awake" approximately eighteen hours out of every twenty-four.

These discoveries of Dr. Galtsoff and his companions are more than interesting bits of hitherto unknown information. They have practical value in giving experts a clearer picture of the problems they have to meet in improving the conditions of this important shellfish.

A definite program for getting ahead financially will be found on page four of this issue.

ANCIENT ARMOR COPIED FOR MODERN WARRIORS

(Continued from page 45)

with it, a surprising amount of steel plate has been donned. Kosciuszko and Rochambeau brought their harness when they came to aid our Revolution and used it. The redoubtable John Paul Jones wore armor. The ironclads of the Civil War which doomed wooden navies had human contemporaries in the soldiers who saved their lives by steel breastplates worn under their uniforms.

The padded cloth armor in the Museum is a reminder of the fact that the luckless Archduke Francis Ferdinand, whose assassination was the spark igniting the conflagration of the World War, was wearing a suit of silk armor when fired upon. It might have saved his life and at least delayed the conflict if the murderer had aimed at his body instead of shooting him in the head.

ARMOR of heavily woven silk is protection against bullets not fired at too close a range or from firearms of too high a muzzle velocity. Though not feasible for field service, it has an advantage in its flexibility; yet this superiority over jointed plate armor is not as great as ordinarily believed. The Metropolitan Museum has graphically demonstrated this in the motion picture showing armor in actual use.

Two reels give a vivid representation of the donning and the putting off of suits of armor. An ironclad figure comes alive, steps from a showcase, and sets forth on such adventures as might have been the lot of the original owner. He performs agile feats, made possible by the skillful joints of his harness. He mounts and rides on a quest through Central Park. He joins combat with a man-at-arms in chain mail, fells him, and stabs him through the vizor of his helmet.

Survivals of the age of armor are pointed out—the straps for corselet and shoulder plates which are the shoulder straps on our uniforms of today; the raising of the vizor, which gave us our salute; and so on. It is made clear how easily armor permitted motion. Its weight often was less than the field equipment of a modern infantryman.

An exhibit of World War armor brings the Museum's collection up to our day. The American "tin hat" reminds that the helmet problem is not yet solved. In his "Helmets and Body Armor in Modern Warfare," Dr. Dean states that we adopted the British model because of expediency in manufacture. The Germans were ahead of us with a type giving the best protection and duplication was out of the question because of confusion that would arise among the combatants. That our efforts toward a new design approached success is indicated by the fact that the Swiss army has adopted a helmet of the type recommended by our Ordnance Department late in the war.

The matter of a vizor is still moot. None yet has been devised to furnish adequate protection without too great a loss of fighting efficiency.

THE armorer of today realizes that the soldier he must protect has not changed his prejudices through the ages. Weight remains as potent a consideration as it was in the sixteenth century when pikemen rebelled and threw away their mail if it tipped the beam over sixty pounds. Armies who took the field unarmored in 1914 began to be converted to helmets on the day that a *poilu* wearing a metal mess bowl under his cap escaped a mortal wound, and fighting men may be persuaded to the wisdom of more body armor than they then wore if it is not too cumbersome. Armor worn under bombardment and then discarded during the attack is a possibility.

HOW WILD OIL WELLS ARE TAMED

(Continued from page 21)

cable had probably fouled the third gate and prevented its closing.

Sand and high pressure were not unexpected problems. It was only in their intensity that they were surprises. Six other wells in the Oklahoma City field had already broken loose. One of them, the nationally famous "Wild Mary" Sudik, was loose for eleven days. During part of this time, another well was spouting. Still another, a gas well, the No. 1 Stamper, caught fire and burned for a week. None of these wells was as close to the city as the No. 1 Stout.

Whenever a driller bores down a mile into the earth and finds oil or gas, he lets an Arabian Nights genie out of the bottle. Under proper control, this genie can move mountains, do wonders. But there is the risk that he will turn out to be a giant on the loose. It is not comfortable when a city of 200,000 finds itself sitting on the safety valve.

THE Stout well genie played a common prank. When the wind came up strong enough, he smeared oil over everything for a distance of more than two miles, far beyond the established danger zone. A fire might have brought calamity. As it was, the damage was annoying and costly. Even the fine state capitol and the new governor's mansion received the misty spray. Residents nearer the well had great difficulty in removing the coat of oil from their houses. Lawns, shrubbery, and trees were ruined. A number of lawsuits were filed, and hundreds of damage claims were handled directly. Streets had to be left covered with oil until dust collected, so it could be washed away.

In some oil fields, local conditions cause additional hazards. In spite of geological knowledge, the element of the unknown persists.

Near Orange, Texas, a drilling crew was startled by a shower of mud and water from the well. They retreated from it. There was a movement of the ground underfoot. When they looked around, the derrick and machinery had disappeared. Where they had been was a crater, forty feet wide, nearly filled with water. The derrick, 112 feet high, had dropped out of sight!

In some other Texas fields, regular oil and gas wells have also yielded hydrogen sulphide, a poisonous gas. Though the quantities are not great, there have been accumulations around wells, and workmen entering them, even for a fraction of a minute, have suffered irritation of the eyes and lungs. At one early well, thirty-one men were overcome. At another well, a driller and tool dresser fell unconscious from the fumes. Before they could be rescued, the oil and natural gas burst into flames and they were killed.

When a well goes wild, it is sometimes much harder to choke than it was at Oklahoma City. At Santa Fe Springs, Calif., a burning well was conquered after a battle of twenty-six days, during which the fighting went on above and below the surface of the earth.

A SHIELD was set up fifty-five feet from the well and behind it workmen dug a tunnel fifteen feet square. They burrowed to the well, with the floor of the tunnel forty-three feet beneath the ground. The casing of the well was penetrated, and oil and gas were piped out.

Three mud pumps were hooked up with the underground connection, and mud, water, hematite, cottonseed, asbestos, cement, and practically everything available was pumped into the well.

The surface fire was lessened and workmen, with wind machines at their backs, and water spraying upon them, went up to the well and capped it.

Another Santa Fe Springs well ran wild for a period of forty-eight days before it could be tamed.

Systems of shutting in wild wells are not always sure to work. One of the most rebellious wells the world has known was drilled at Moreni, Rumania. The equipment had been tested to 3,000 pounds pressure. The well blew in with 3,600 pounds pressure and a flow of 177,000,000 cubic feet of gas a day. It caught fire.

ATTEMPTS to shut it in have cost the lives of ten workmen. Three tunnels have been dug to the well, one of them 195 feet below the surface, and each of these ventures has ended with a fatal accident. In one of these attempts, directed by the Rumanian Inspectorate of Mines, a twenty-ton "T" was saddled onto the casing, and mud was forced into the well. Escaping gas caused an explosion that wrecked the tunnel, killing two men.

This fire started May 28, 1929, and, at this writing, *it is still burning*, both at the well and at the mouth of the tunnel.

Though the Rumanian well is an extreme case, it illustrates a potential menace. Obviously no town wants anyone to come inside its limits and dig up a volcano that cannot be controlled.

Once oil is discovered, restriction is a difficult problem. Signal Hill was once a beautiful residential section on the edge of Long Beach, Calif. Today it is a forest of oil derricks. Lovely homes, surrounded by wells, have been converted into offices and headquarters of oil companies.

The first well near Oklahoma City was at a safe distance from the city limits. New wells have extended the known boundaries of the oil pool toward the town, creeping steadily in, raising their derricks against the sky nearer and nearer the city limits.

Several projects to drill wildcat wells within the city were forbidden. Then the pool was proved up to the edge of town, and permission was granted to drill inside, in a carefully restricted zone. Before the field of operations stopped spreading, it appeared that the pool extended under the wholesale district, and a good part of the hotel and retail section.

The city opposed enlargment of the drilling zone, but it met a determined fight. A property owner grows impatient when he is forbidden to drill, while his neighbor, across the line, is taking oil from beneath his land and growing rich.

The wild No. 1 Stout brought the issue to a head. Two applications to drill additional city park land were flatly refused. The state was appealed to, to enforce safety regulations upon wells near the city limits.

In effect, Oklahoma City says to oil seekers:

YOU shall not pass this safety line. On the other side, you may drill, but bring in all wells under control. Have all equipment strong enough to withstand the maximum possible strain. Be prepared to meet any emergency immediately.

"It is claimed that these wild wells were unavoidable. No wild well is unavoidable. If there is no other way, it can be avoided by not drilling it. Take your choice.

"This town profits by oil, and appreciates it. But it was here before the oil was discovered, and it intends to remain here long after the oil is forgotten."

CAR DIAL WARNS OF DEADLY GAS

(Continued from page 23)

the indicating meter, as shown in the accompanying diagram. Power is supplied by the car's battery. So exactly is the electrical resistance of the cold platinum filaments balanced by strips of nickel that no current ordinarily flows through the meter. But when the platinum wires glow, their resistance mounts rapidly. The circuit is unbalanced. Current flows through the meter, and the needle then swings over to indicate how much carbon monoxide is pouring through.

The telltale device, Hutchison says, in measuring monoxide gas, also measures unburned, wasted fuel—for the two mean exactly the same thing. A car tuned up with the aid of the meter will go miles farther for every gallon of gasoline it burns. Dr. Hutchison makes the amazing estimate that if every car in America were equipped with such a meter, a billion-dollar-a-year waste of gasoline, now going out into the air with exhaust would end.

FOR perfect combustion, the fuel-and-air mixture which your car's carburetor supplies to the motor should be changed to suit the weather—hot, cold, fair, or rainy. At present this can be done only by guesswork. With the aid of the "monoxide meter," the most inexperienced motorist can tune his car as accurately as an expert mechanic.

Once a day, say he would watch his meter, with the engine running, and adjust the carburetor until the meter needle read only about "Five Percent" of fuel wasted. At this setting the motor emits practically no monoxide, a little waste is unavoidable in order to avoid overheating caused by the slow burning of too "lean" a gasoline mixture.

One popular make of car has a carburetor-adjusting knob on the instrument panel, making the adjustment possible from the driver's seat. Other makes of cars could quite easily be fitted with similar attachments.

Dr. Hutchison's invention is not intended exclusively for pleasure cars. It may be installed on a truck, a bus, or even a boat, railway motor car, or airplane.

The other day the inventor fitted one to the fast plane of Capt. Frank M. Hawks, aerial speed king, and said that it would increase his cruising range from 700 to 1,000 miles with the same amount of gasoline carried. On his first trip with the device from New York to Memphis, Tenn., Hawks reported a forty percent fuel saving.

IN FACT, Dr. Hutchison told POPULAR SCIENCE MONTHLY, his first model was intended for airplanes, and that the "monoxide meter" for automobiles was an afterthought.

A tragedy inspired the invention. In 1928 the younger of Hutchison's two sons, Harold, was killed in an airplane crash. According to the inventor, that was what made him roll up his sleeves, don his green eyeshade, and set to work in his laboratory to invent a device that would make airplanes safer for others. He visioned an instrument that would enable a pilot, caught in fog, to conserve his last drop of gasoline and avoid a forced landing. When he found it, he discovered that the same device, with practically no change, could be fitted to motor cars. A number of test cars are now en route throughout the United States trying out the device, which may be placed upon the market this year.

If it Climbs *this* HILL *it will climb anything*

GOOD, ordinary gasoline is in the tank, and yet the engine is "knocking" as if it were on the steepest hill in the world. It is.

Those rollers under the rear wheels are harder to climb than Pikes Peak. The dynamometer shows their resistance is equal to a 20% grade.

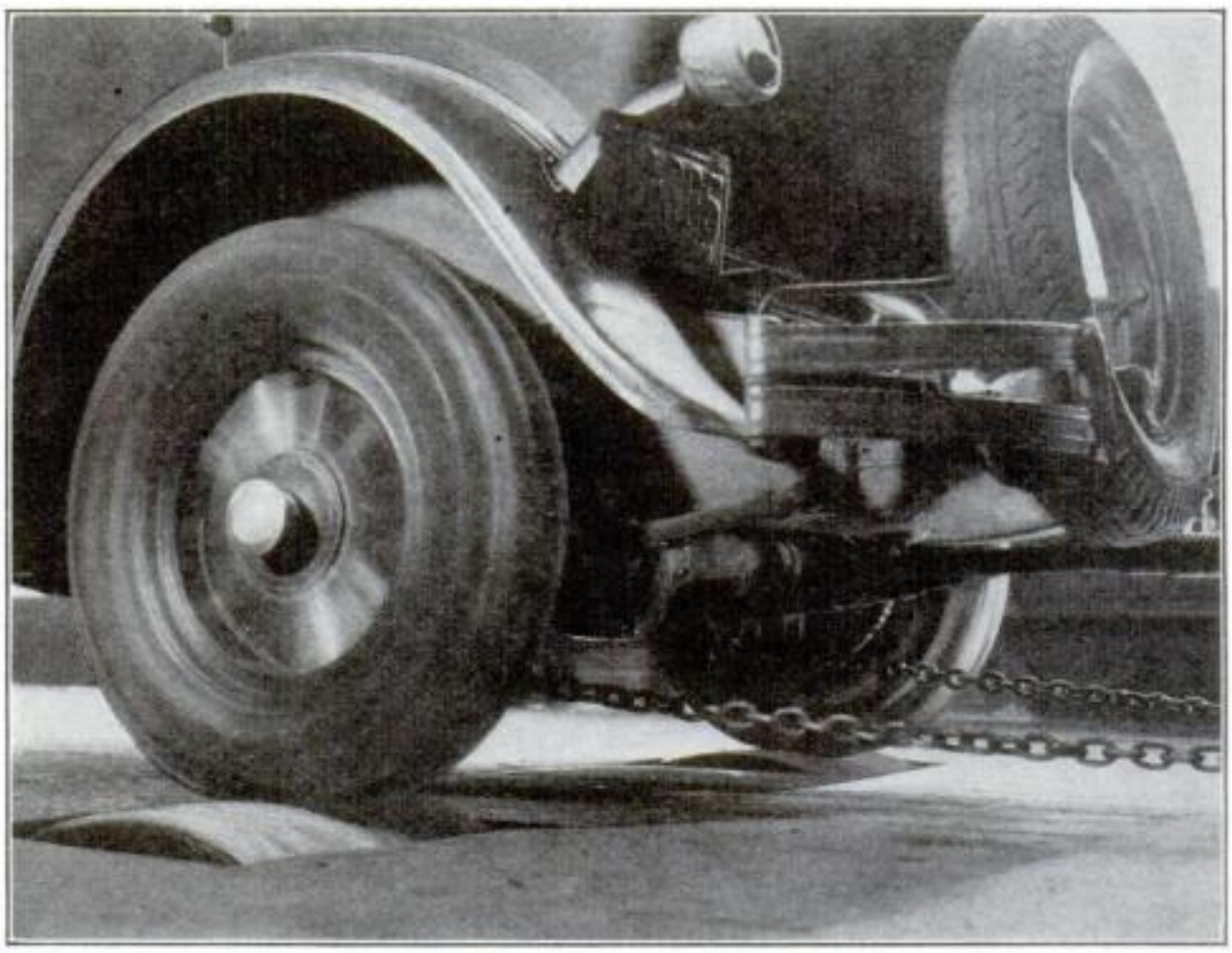
But switch the gas feed from ordinary gasoline to Ethyl Gasoline. The knocking stops, the wheels begin to roll faster, and the driver shifts back to high.

What is the difference? A gallon of good gasoline was used for fuel at first. Another gallon of identical gasoline *plus* a teaspoonful of Ethyl fluid was used for the second test.

These few drops of Ethyl fluid prevent the uneven explosions of gasoline that cause power-waste, "knock" and over-heating. They *control* combustion so Ethyl Gasoline delivers its power to the pistons with smoothly increasing pressure.

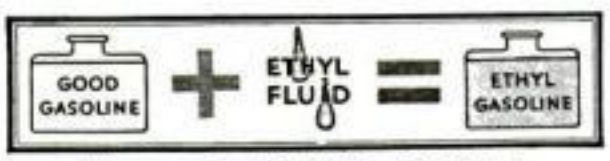
This test does *more* than prove that Ethyl Gasoline prevents "knocking" under strain. It proves that the greater power Ethyl Gasoline gives on any kind of road is not only greater engine power, but greater rear-wheel power.

Try Ethyl Gasoline in your car. See how it increases power, gives you quick get-away and sends you zooming up hills in high. You will find pumps everywhere marked with the Ethyl emblem. Ethyl Gasoline Corporation, Chrysler Building, New York City.



The mounds under the wheels are braked to tax pulling power more than the steepest hill in the world.

This isn't a dynamo in the left of the picture; it is a dynamometer which measures the pull on the rollers under the wheels of the car.

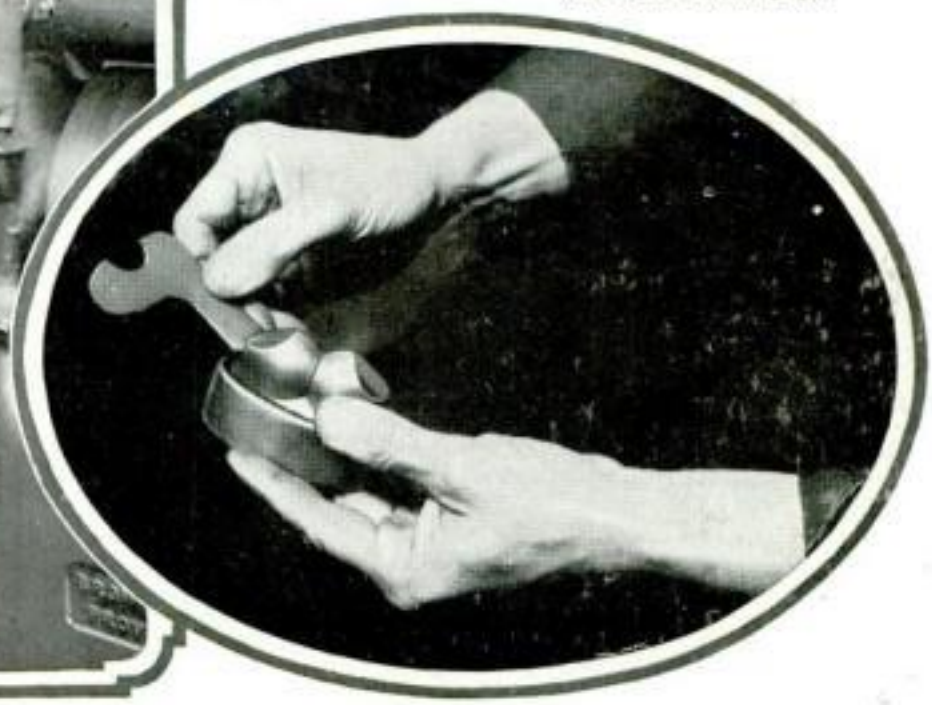


The active ingredient in Ethyl fluid is lead

ETHYL
BRAND OF ANTI-KNOCK COMPOUND
ETHYL GASOLINE CORPORATION
Knocks out that knock

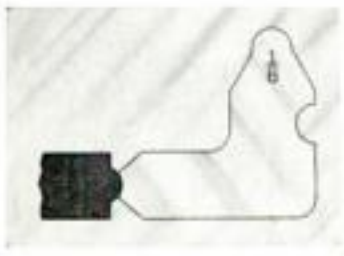
ETHYL GASOLINE

John Kunst using radius gages on current work in his shop.



Showing the application to the work of the LUFKIN new style radius gage.

Where Inventors' Dreams Come True



View No. 3—Work being checked on a piece of glass.

View No. 1—Gage used for determining radius of inside corners.

View No. 2—Gage used for determining radius of outside corners.

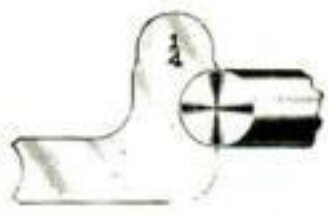
WHO would think of leaving a place like Budapest to find romance? John Kunst left his old world foundry and came to America 26 years ago. Now he owns a shop where the singing of belts and lathes is music to inventors who watch their dreams turn into perfect working models in the skilled hands of the craftsmen employed by the John Kunst Co., at 43 Murray St., New York City.

"We have filled over 150,000 orders" says John Kunst, "orders for everything from simple patterns to complete working models of big and intricate machines."

These comparatively tiny working models must run and demonstrate the application of new discoveries or principles. They must be made with hair line precision. ***"In this fine work we use Lufkin Radius Gages—they are the handiest and safest" said Mr. Kunst. "You don't need to have a whole bunch of gages in your hand interfering with the work." Lufkin Radius Gages are made so that each gage is a separate unit, for convenient and accurate application to the work. Each gage has five forms, 3 radius and 2 fillet, and the straight sides are at 90° for checking location of radius.***

Here is a scientific tool that is NEW in design and far more practical in actual work than the old type gages. Lufkin precision tools are the result of painstaking research to put every modern convenience into the hands of the skilled craftsmen of today.

View No. 4—Shows gage used on concave cutter of ½ circle or less.



View No. 5—Checks ½ of a circumference.

For accuracy, improved design and construction, finer finish and balance—demand

LUFKIN PRECISION TOOLS

THE LUFKIN RULE CO., SAGINAW, MICH.

106 LAFAYETTE STREET, NEW YORK, and WINDSOR, ONTARIO

No. 77 A
16 Gages
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Send for this FREE CATALOG

112 pages containing valuable tables of decimal equivalents of number and letter size drills, U. S. Standards for Wire Gages, double depth of threads, weight of iron and sheet steel, metric system, etc. Also illustrations and descriptions of the complete line of Lufkin Precision Tools, including Micrometers, Calipers, Dividers, Combination Squares, Steel Rules, Depth, Thickness, Surface, Screw Pitch and Radius Gages, and practically every other fine tool the shop requires.

THE LUFKIN RULE CO., Dept. "B",
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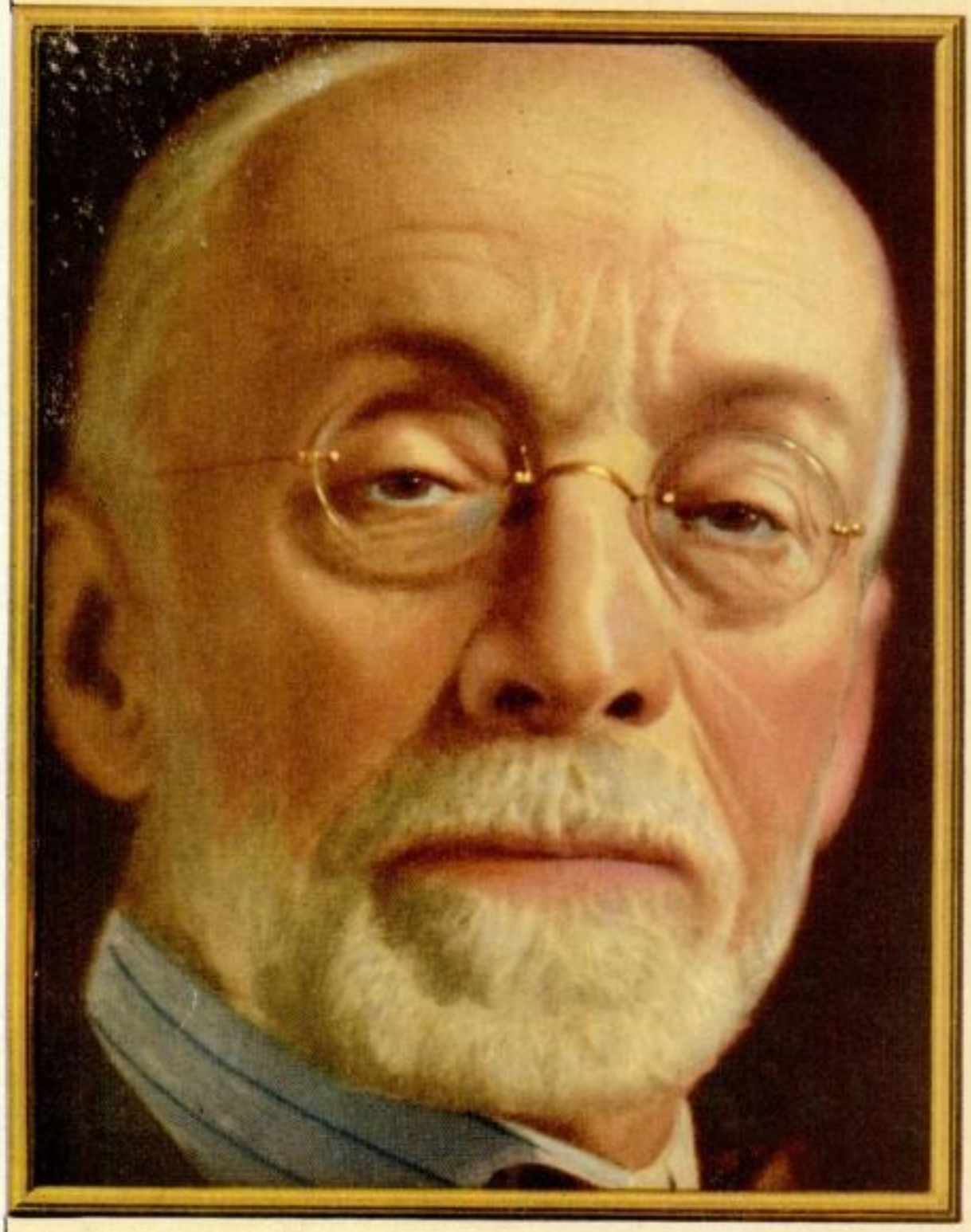
This seal on an advertisement in POPULAR SCIENCE MONTHLY signifies the approval of the INSTITUTE OF STANDARDS See page 8.

"A DISTINCT CONTRIBUTION"



Says

AUGUST HECKSCHER

Noted Philanthropist

Chairman of the Heckscher Foundation for Children; President Child Welfare Committee of America

Director:
Empire Trust Company
Crucible Steel Company

"The most laudable service that any industry can render is the attempt to benefit its patrons. That is the cardinal principle of philanthropy. And so, interested as I always am in modern developments, I consider that your use of the Ultra Violet Ray in your Toasting of LUCKY STRIKE is a distinct contribution of which the public will whole-heartedly approve."

A. Heckscher

Everyone knows that sunshine mellows — that's why TOASTING includes the use of the Ultra Violet Ray. LUCKY STRIKE — the finest cigarette you ever smoked, made of the finest tobaccos — the Cream of the Crop — THEN — "IT'S TOASTED." Everyone knows that heat purifies and so TOASTING removes harmful irritants that cause throat irritation and coughing. No wonder 20,679 physicians have stated LUCKIES to be less irritating!

"It's toasted"

Your Throat Protection — against irritation — against cough

Consistent with its policy of laying the facts before the public, The American Tobacco Company has invited Mr. August Heckscher to review the reports of the distinguished men who have witnessed LUCKY STRIKE'S famous Toasting Process. The statement of Mr. Heckscher appears on this page.